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33d Congress, 2d Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. No. 91.

REPORTS

OF

EXPLORATIONS AND SURVEYS,

TO

ASCERTAIN THE MOST PRACTICABLE AND ECONOMICAL ROUTE FOR A RAILROAD

FROM THE

MISSISSIPPI RIVER TO THE PACIFIC OCEAN.

MADE UNDER THE DIRECTION OF THE SECRETARY OF WAR, IN

1853-4,

ACCORDING TO ACTS OF CONGRESS OF MARCH 3, 1853, MAY 31, 1854, AND AUGUST 5, 1854.

VOLUME IV.

WASHINGTON:
A. O. P. NICHOLSON, PRINTER.
1856.

IN THE HOUSE OF REPRESENTATIVES—February 14, 1855.

Resolved, That there be printed, for the use of the House, ten thousand copies of the reports of surveys for a railroad to the Pacific, made under the direction of the Secretary of War, embracing the report of F. W. Lander, civil engineer, of a survey of a railroad route from Puget's Sound, by Fort Hall and the Great Salt lake, to the Mississippi river; and the report of J. C. Frémont, of a route for a railroad from the head-waters of the Arkansas river into the State of California; together with the maps and plates accompanying each of said reports necessary to illustrate them

Attest: J. W. FORNEY,

Clerk of the House of Representatives of the United States.

THIRTY-SECOND CONGRESS, SECOND SESSION—Chapter 98.

Sect. 10. *And be it further enacted*, That the Secretary of War be, and he is hereby authorized, under the direction of the President of the United States, to employ such portion of the Corps of Topographical Engineers, and such other persons as he may deem necessary, to make such explorations and surveys as he may deem advisable, to ascertain the most practicable and economical route for a railroad from the Mississippi river to the Pacific ocean, and that the sum of one hundred and fifty thousand dollars, or so much thereof as may be necessary, be, and the same is hereby, appropriated out of any money in the treasury not otherwise appropriated, to defray the expense of such explorations and surveys.

Approved March 3, 1853.

THIRTY-THIRD CONGRESS, FIRST SESSION—Chapter 60.

Appropriation: For deficiencies for the railroad surveys between the Mississippi river and the Pacific ocean, forty thousand dollars.

Approved May 31, 1854.

THIRTY-THIRD CONGRESS, FIRST SESSION—Chapter 267.

Appropriation: For continuing the explorations and surveys to ascertain the best route for a railway to the Pacific, and for completing the reports of surveys already made, the sum of one hundred and fifty thousand dollars.

Approved August 5, 1854.

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PART V.

EXPLORATIONS AND SURVEYS FOR A RAILROAD ROUTE FROM THE MISSISSIPPI RIVER TO THE PACIFIC OCEAN.

WAR DEPARTMENT.

ROUTE NEAR THE THIRTY-FIFTH PARALLEL, EXPLORED BY LIEUTENANT A. W. WHIPPLE, TOPOGRAPHICAL ENGINEERS, IN 1853 AND 1854.

REPORT

ON

THE BOTANY OF THE EXPEDITION.

WASHINGTON, D. C.
1856.

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No. 1.

GENERAL DESCRIPTION

OF

THE BOTANICAL CHARACTER OF THE COUNTRY.

BY J. M. BIGELOW, M. D.

GENERAL DESCRIPTION OF THE SOIL AND PRODUCTIONS ALONG THE ROUTE TRAVERSED.

WASHINGTON, D. C., *August*, 1854.

SIR: In compliance with your instructions, I have the honor to submit to you a report on the forest trees, the productions of the soil, and its capacity for sustaining a civilized population, upon the railroad route near the 35th parallel, over which you had command.

Very respectfully,

JOHN M. BIGELOW.

Lieut. A. W. WHIPPLE, *Topographical Engineer, U. S. A.*,
in charge of exploration for railroad route near the 35th parallel.

SECTION I. *Napoleon, on the Mississippi, to Fort Smith, Arkansas.*—From Napoleon to Fort Smith, our way being on steamboat, I could, of course, give but a limited account, either of its forests or of its soil. The banks of the river were densely lined with timber-trees of great variety. Among the kinds observed we particularly noticed the black walnut, sweet-gum, (liquid ambar styraciflua,) pecan, white ash, three kinds of elms, five or six species of oaks, Osage orange, and sassafras, with their dark green foliage; all most luxuriant and beautiful. At Little Rock, among some of those just mentioned, we saw the American holly, (Ilex opaca,) spice-wood, and June berry, (Amelanchier canadensis.) Near Piney Point, at the Sugar-loaf mountain, as well as on our route in the Indian Territory, was found what was considered to be *Pinus mitis*, the common yellow pine of the southern States, quite different from the one in New Mexico, known there by the same common name. We also observed, in passing, witch-hazel, hop-horn beam, birch, Kentucky coffee-bean, honey-locust, black locust, sour-gum, red-bud, box-elder, mulberry, dogwood, blackberry, &c., &c., all indicating a soil of the utmost fertility. It is unnecessary to extend the list beyond the few seen from the boat, as the botany of this country has been described and is well known, having been visited by Nuttall, and other eminent naturalists and botanists.

SECTION II. *Fort Smith to Valley river.*—The range of country embraced between these two points is about four hundred and sixty miles. The western limit of this section is some distance west of the line between Texas and the Indian reservation. Consequently, it embraces

the entire limits of the Indian Territory, from east to west. It constitutes a most natural division, being in nearly its whole breadth a beautiful and fertile country, of vast agricultural capacity, and of sufficient dimensions for forming two or three large and magnificent States. The eastern portion is densely covered with timber, of the same varieties and qualities as those enumerated between Napoleon and Fort Smith. The western portion has by no means so great a variety, being mostly grassy plains, with intersections of timber along the streams, arroyos, and ravines. The celebrated "Cross Timbers" is situated along and crosses our line of survey, extending some distance north, and, according to Captain Marcy, about two hundred miles south of it.

The streams are Sans Bois creek, Gaines' creek, Topofki creek, Deer creek, False Washita, Walnut creek, Dry creek, Valley creek, &c., with their various tributaries, as also others of the Canadian and Washita rivers. Near old Fort Arbuckle, and in the vicinity of the "Cross Timbers," the scenery is most beautiful and picturesque. Belts of timber crossing the more elevated plateaux in various directions many times, at right-angles with each other, give them the appearance of vast cultivated fields, formed on a scale of great magnificence, stretching away in every direction as far as the eye can reach. The same beautiful views were noticed in the vicinity of Delaware Mount, near the centre of the Indian territory.

The first appearance of the celebrated "grama-grass" was here noticed, opposite Little river, a small branch from the north side of the Canadian, in about longitude 96° west. This important grass is found, in greater or less abundance, from this point across the continent, or as far as to the mountains of the Sierra Nevada, which, where we crossed it with our line of survey, was not far from the Pacific shore. The great importance of these western prairie grasses, of which we have several species besides this and the buffalo grass, consists in their retaining their nutritive qualities the whole year round, sustaining the life and condition of the beast of the traveller, thereby enabling them to pursue their journey at leisure at all seasons of the year. Were it otherwise, much hazard would be encountered, as it is impossible to transport forage in sufficient quantities to supply a long train over a country of such vast extension. When the tops of these grasses become dry, the stems near their roots retain their vitality and nutritive juices until the plains are again renovated with a new crop. Many of our farmers express a wish to introduce the culture of these grasses at home; but it is to be presumed, from the peculiarities of their situation, that they are only well adapted to the arid climates, where they are found in their native state.

The trees in the western portion of this region consist of several species of oak, black walnut, cotton-wood, buck-eye, elm, mulberry, and a few cedars. Helianthi, Convolvulaceæ, Euphorbiaceæ, Vernoniæ, Eupatoriæ, with shrubby and herbaceous Mimosæ, are common in this region. The Wild China, (Sapindus Marginatus,) common all over Texas, was found here. Mirabilis, (Marvel of Peru,) Evening primrose, Ambrosia, Silphium, (rosin plant,) Golden rods, &c., are abundant on the plains. American and Chickasaw plums are quite common on the banks of the Canadian and other streams, but on the plains is found a small shrub, bearing in abundance what is called prairie plums, which is probably undescribed.

A considerable number of cactaceæ, which always indicate a dry climate, begin here to make their appearance, especially when we come into what appropriately may be termed the grama-grass region. Among them I recognised Opuntia Macrorhiza, (?) having tuberous roots, which appears to be quite extensively diffused in this region. One very similar, if not the same, was detected as far east as Fort Smith. A plant nearly allied to O. Engelmanni was collected at Delaware Mount. The little *Cereus cæspitosus*, so common in lower Texas, was also found here in great abundance. We were sorry not to find a flower or fruit of this pretty little plant, which would have enabled us to solve some obscure points in the natural history of the unique and interesting tribe of plants to which it belongs. The cactaceæ have not heretofore been well studied in the United States, Dr. Engelmann, of St. Louis, being almost the only botanist who has paid any special attention to them.

The whole of this region from Fort Smith to Valley river is eminently calculated to sustain a large population. Although the soil itself, probably, is not as rich as that of Arkansas, yet the ease of raising stock, for which few other countries are better adapted, and the exemption from sickness, will greatly counterbalance this difference. Water, in most places, will be found abundant for all agricultural purposes. In some places, however, especially on the head-waters of the Washita and Red rivers, it is quite brackish, being impregnated with the salts of lime and magnesia, but not sufficiently so to prevent it from being used for domestic purposes. Should a purer kind be required for railroad uses, I presume it can be obtained from the Canadian, which appears to be much more free from mineral impregnation.

Section III. *Llano Estacado.*—It would seem proper to include in this region the space on our route between Valley river and Fossil creek, near Tucumcari hills. This is a dry, and generally timberless tract of country, extending over a distance of about one hundred and ninety miles. Over this region, and the western portions of the last, immense herds of buffaloes range at certain seasons of the year, but they evidently make no prolonged stay here; passing from the waters of the Arkansas and Canadian rivers, south, to those of Red river and its tributaries, and thence back again. If not in these days, they formerly ranged south as far as the waters of the Brazos, Colorado, and other Texan rivers, where there are vast hunting grounds for the great Comanche and Kioway tribes of Indians. The noble wild animal upon which these red men of the plains mainly subsist is already becoming greatly diminished in numbers, by the restraints of the settlements, and by the military occupancy of their grounds. Certainly the *manifest destiny* of the Indian is to disappear from the face of the earth, and become extinct, unless he conform to the usages and habits of civilized life, which at present seems quite improbable.

Along the banks of arroyos, or dry creeks, may be found a few alamos; and under the northern and eastern bluffs of the Llano Estacado, and detached surrounding hills, may be found Piñon pine, (Pinus edulis,) and two kinds of cedars. They are, probably, too much stunted and shattered by the prevailing winds to form very useful timbers. It is to be remarked, that the wind blows with tremendous force over these immense denuded plains, and this, we have reason to believe, is one great cause of the destitution of timber in this region. In confirmation of this opinion is the fact, that wherever the least shelter by a bluff or rock is afforded, the modest cedar will rear its head, thankful, as it were, for this partial protection. The stature of the tree appears to be limited to the height and amount of shelter it thus receives. The timber that may be needed for railroad purposes here, will have to be supplied from other districts each way, probably from the Indian territory on the east, and the mountains of the Pecos and Rio Grande on the west, where timber of excellent quality abounds, and from whence it can be easily procured.

Although grass is abundant, yet the scarcity of water will greatly lessen its value as an agricultural district. Very little of this indispensable element is to be found, except along the course of the larger rivers. However, during the more moist seasons of the year, sheep can be grazed, without doubt, over large tracts of this district; as in New Mexico they are driven, herded, and grazed, hundreds of miles from their usual places of abode. Sheep can be grazed a much greater distance from water than cattle or horses. So that when the country between the Eastern States and New Mexico comes to be settled, the difficulties from the depredation of Indians obviated, and security established, this country may prove highly valuable for grazing purposes.

This is more emphatically the region of cacti than the one just left on the east. The singular and rather pretty, but formidable *Opuntia arborescens*, described by Dr. Engelmann, is first found here. It extends west as far as Zuñi, and in southern Texas as low as Presidio del Norte. In this region were found several new and undescribed species, which will be described in another and more appropriate form. The piñon, or *nut pine of New Mexico*, here first makes its appearance, and is presumed to be its eastern limit, extending west as far as the Sierra

Nevada mountains of California. The real grass-leaved dasylirion was first seen here, on the bluffs of the Llano Estacado. It is identical with the one found on the San Pedro, or Devil's river, in Texas. There is another species, with the leaves and habit somewhat of a Yucca, named *D. graminifolia*, I suppose because it does *not* resemble a grass. A rosaceous shrub (*Cerco carpus*) and a shrubby oak (*Q. Emoryi?*) are also common under the bluffs. We have not now the means at hand to determine whether they are the same as occur in lower Texas and New Mexico. Eriogoneæ, another characteristic tribe of plants peculiar to dry climates, begin here to make their appearance in considerable numbers. Mentzelias and asteroid composites are also quite abundant. An Ephedra, much used as a diuretic, especially for horses, was first seen here. The genus is also common in lower Texas, where I know two or three distinct species of it.

Section IV. *Tucumcari and Pecos Valleys.*—Although the waters of these two valleys flow into the Gulf of Mexico, by widely-separated channels, yet they may well be considered in one district—being included in the space of about one hundred and seventy miles, from Fossil creek to the dividing highlands between the Rio Pecos and Rio Grande del Norte.

At Tucumcari we have a broad, beautiful, and fertile valley, abounding in most luxuriant grasses, and extending north to the Canadian, but its exact limits we had not time to explore. Although the timber is somewhat scarce, yet, ascending the hills on either side, cedars and piñon become much more abundant, and both attain a higher stature than on the Llano Estacado. Along the banks of the streams there are a few cotton-woods and box-elders of very pretty size. The Gallinos, whose outlet is south into the Pecos by narrow defiles near our line, is a beautiful, bold, clear, running stream, affording water at all seasons of the year, while the Tucumcari and Pajarito creeks, in the immediate vicinity of the Tucumcari hills, flowing north into the Canadian, will afford water doubtless nearly all the year. At any rate, when we passed, (21st September,) there was plenty, flowing in a rapid, turbid stream. The water of Laguna Colorado, which is near, or forms, the sources of these streams, is somewhat brackish.

We collected here, for the first time, specimens of another shrubby cactus, (Opuntia frutescens,) which is so abundant all over southern New Mexico and Texas, as far south as Eagle Pass and San Antonio. It is a very ornamental species, especially when loaded with its scarlet berries. On the hills in this region were found, and collected, several new mamillaria; beautiful flowering and fruiting specimens of which are now growing in the Congressional gardens, in Washington. *Opuntia Engelmanni*, which is probably the most widely spread of the whole tribe of American cactaceæ, was first detected in the rocky cañons of the Gallinos. *Fallugui paradoxa* and *Fendlera rupicola*, two beautiful shrubs, are common here; both of them common to Texas also. There are, likewise, several other Texan plants in this region, among them a *Parthenum*, *Thymophylla greggi*, and a great variety of leguminous and asteroid plants. Several species of eriogoniæ also make their first appearance here. As their geographical limits extend westwardly some distance, most of the eriogoniæ which were collected here will most probably prove to be those which are figured, and well characterized, by my excellent friend *Dr. Torrey*, in Captain Sitgreaves' report of the Zuñi expedition. As we proceed a little further west, we come to the Pecos valley, where, in addition to the piñon and cedars met with before, and already mentioned, we find pine trees of a majestic size, (Pinus brachyptera, *Engl.*,) that are as valuable for timber as almost any in the world.

The Pecos river is here clear and rapid, its waters pure and sweet, forming quite a contrast to those at the several crossings from San Antonio to El Paso, where they are always turbid, brackish, and disagreeable. Indeed, by some travellers on its lower borders, and on some maps, this river, from these circumstances, has acquired the name of Puerco, the Spanish appellation for muddy waters. There, its valley, for hundreds of miles, is a blank and dreary waste, with scarcely a shrub to relieve the eye of the traveller; here, its fertile banks are dotted with innumerable small plantations, and towns, so characteristic of New Mexico.

This river, with the Gallinos, will form a never-failing supply of water for the erection of all

kinds of mills and machinery, when the time for such wants has arrived. These considerations, in connexion with the fact of its forming a middle and connecting link between the Atlantic and Pacific shores, give it a high degree of interest at the present time. The region is large enough for a State of the first magnitude, and contains all the natural elements of self-sustenance, excepting, probably, commerce. The difficulties which alone now prevent this district, and that of the valley of the Rio Grande, from rising to its proper scale of importance, will in a great measure be obviated as soon as any Pacific railroad is established and finished. Should any other route than this be adopted, the road, either north or south, can be easily tapped, so as to diffuse its beneficial influences to this whole country. The quality of the soil, though not equal to that of the Indian territory west of Arkansas, is superior to that of the Rio Grande valley, either in New Mexico or Texas. It is probably as well adapted to sheep grazing as any other country in the world. There can be no doubt, when properly settled, and easy communications can be safely had with the great Eastern States and with California, that it will prove equal, also, to any other country, as a resort for consumptive invalids.

Section V. *Rio Grande Valley.*—What there is to be remarked of this valley will be brief, because it is an old and well known region, having been settled by the Spaniards about three hundred years ago. Gregg's Commerce of the Prairies gives a vivid, and generally truthful, view of this country, and its capabilities for agricultural productions. There is not time now, nor indeed is it in place, to enter into a comparative view of the adaptation of this country to consumptive invalids, with those of foreign countries, or with other places in the United States; but little is hazarded in asserting, that in no long time this, and the upper Pecos valley, will become one of the most important and eligible places in the whole world for such purposes. As soon as communications with the Eastern States and California become speedy, cheap, and regular, as well as free from the danger with which they are at present attended, and when the ordinary means and comforts of living are easily and cheaply procured, so as to come within the reach of the yeomanry of the land, a trip and sojourn to this country will form as pleasant an excursion as to any part of our country can, and many an invalid will then avail himself of the recuperative influences of this climate. The summer heat is greatly modified by the peculiar aridness of the atmosphere, which, by rapidly carrying off the perspiration before it has time to accumulate to any sensible degree, cools the surface of the body, and makes the summer truly delightful, especially to an invalid. The winter is mild, being screened from the penetrating winds of the north by intervening mountains. The terrible *norther*, so well known and dreaded by the inhabitants and travellers in lower Texas, is not known here. Many invalids who at present resort to San Antonio for their health, experience various bad effects from the sudden changes of the weather, resulting mainly from those "northers."

The width of the Rio Grande valley, at the point where we crossed it (which was at Albuquerque) from the dividing ridge between it and the Pecos, and the highlands or mountains between its waters and those flowing westward into the Gulf of California, is about one hundred and seventy miles. Its length in the Territory of New Mexico is embraced between about the thirty-second and thirty-eighth degrees of north latitude; which, with its tortuous course, would give it a length of about four hundred and thirty miles. This of course embraces a great variety of climate, independently of the effect produced by the highly elevated ranges of mountains which partly environ it on the east and west.

The soil is well adapted to the cultivation of all the finer fruits and vegetables, as well as the cereals; but it requires irrigation. Grapes, apricots, pears, and melons, are produced in the utmost perfection and abundance. The grapes, especially, are far superior to any that can be cultivated at home, in the open air. Beets, sweet potatoes, and pumpkins do equally well, if not better than in the Eastern States. But the Irish potato does not succeed, excepting in the mountainous regions. On account of the cost of irrigation, wheat and corn cannot be raised as cheaply as in the Western Atlantic States; nevertheless, by irrigation they do very well, and large quantities of both are produced.

SECTION VI. *Valley of Zuñi.*—In this region, we would embrace the scope of country between the summit of the Sierra Madre, or mountains bordering the Rio Grande valley on the west, and Mount San Francisco; the principal and pervading stream of which is the Colorado Chiquito, a tributary of the Colorado Grande, or, as it is more aptly termed, the great Colorado of the West. The general course of this valley is northwest and southeast; the extent of which (in our rapid exploration) we were unable to determine. Its width, travelled, is about two hundred and fifty miles.

At Zuñi, the Indians of the Pueblo tribes raise corn, and many other vegetables, without resorting to irrigation; but from the appearance of the soil on the bottoms of the Colorado Chiquito, it was considered by most of our party that irrigation might be necessary. In the immediate vicinity of the mountains there is evidence of an amount of moisture in the soil, which is wanting in the centre of the valley, more remote from their influence. The water of the Colorado Chiquito is sufficient to irrigate a portion of the central part of the valley, but probably not enough to make all the tillable lands available for agricultural purposes. There are many beautiful streams of water of limited extent, on both ranges of the mountains, which look into this valley from the east and the west. These streams would be sufficient for small settlements in their immediate neighborhood; but on descending into an almost unlimited arid plain, they are lost by the absorptive power of the soil, and the rapid evaporation caused by the dry atmosphere. The Rio Mimbres, in the valley of which is situated Fort Webster, southeast of the Mogoyon, (which has been made well known by the operations of the Mexican Boundary Commission) is a good example of these facts. Such is the case, also, with nearly all the mountain streams in these arid regions.

Grass throughout this whole country is very abundant, and of a most excellent quality, especially around the mountain bases, and on the more elevated plateaus. Large herds of cattle and sheep might be reared and sustained here, were it not for the depredations of the Indians. We were told by Mr. Leroux, that the wild Indians of this country, in their blind eargerness to obtain the flesh of mules, have been known to shoot one down with their arrows while a traveller was yet seated on his back, for which, in a case that he mentioned, the poor savage paid the penalty of his life.

Unfortunately, we passed this region between the 18th of November (when we crossed the crest of the Sierra Madre) and the 25th of December. At the latter date, we encamped at the base of the San Francisco mountain. This was the most unpropitious season of the whole year for the collection of herbaceous plants, and must account for the meagreness of my collections in this part of our journey.

The entire eastern, southern, and part of the western, angles of this region, are well timbered with Douglas's spruce, New Mexican yellow pine, piñon, and balsam fir. The Rocky mountain white pine (Pinus flexilis) grows on the San Francisco mountain, and no doubt on the higher peaks and ranges of the Sierra Madre and Mogoyon. Oaks and black walnut also grow here. The banks of all the streams that are crossed produced cotton-wood and mezquite—in some places in great abundance. Three kinds of cedar abound at the base of the mountains, frequently extending (in more limited quantities) down to the banks of the Colorado Chiquito, wherever the evenness of the surface appears to be broken by dry arroyos or broken banks.

On the slopes east and south of San Francisco mountain, looking into this valley, and also westwardly, are vast forests of piñon, intermingled with cedars, perfectly black in the distance, by their density. From elevated points near the southern base of Bill Williams' mountain we had extensive and beautiful views of these forests, which extended southwestwardly, apparently some fifteen or twenty miles. This one we denominated the "Black Forest." With the aid of the telescope, we could detect (*January 3d, side reconnoissance*) the camp-fires of the Tonto Indians, in several places, in the forest. We were informed by our guide, Mr. Antonio Leroux, who has had much experience, and even desperate forays, with the Indians of this neighborhood, that, at the proper season of the year, large parties of the Yampai, Tonto, Coyotero,

Garretero, and other sub-tribes of the great Apacherian race, resort here for the purpose of collecting the fruit of this pine. It probably forms one of the most important articles of their subsistence. In an economical view of this country, it should not be forgotten or overlooked.

Immediately on our entrance into this valley, (November 19th,) we found and collected a new species of Opuntia, with prostrate, nearly terete joints, entirely devoid of woody fibre; and at Zuñi, soon after, another, with a woody stem, low and prostrate, clearly distinct from O. arborescens, to which it somewhat approaches in its reticulated woody axis. Its fruit, seeds, spines, and general habit, however, separate it from that well-known and widely disseminated species. Very pretty specimens in fruit were obtained, but none in flower, which is much to be regretted. As this tribe of interesting plants was almost the only one we could find and study, at this late season of the year, our party rivalled each other in daily bringing some of them into camp that had not been before seen or collected. Sometimes one would come in ahead of the others, but more frequently several would arrive at the same time with new specimens, and then a great shout would ensue, in deciding upon the claims of priority. Lieutenant Whipple discovered the first specimen of our new *Cactodendron*, as we were pleased to call it, to distinguish it from the O. arborescens. We saw this same species afterwards growing six to eight feet high, retaining all its peculiar characteristics, with the exception of not being prostrate. While on the banks of the Colorado Chiquito, and only in that vicinity, we found a new Echinocactus, the first of this genus met with on our route, but it was neither in flower nor fruit. It is quite limited in its range, having been found only along the bottom lands of the Rio Colorado Chiquito. In the rocky ravines, soon after leaving the river bottoms, we discovered a densely aggregated Cereus, growing in large oval masses, which contained hundreds of low, ovate, fleshy stems, from one root. Our highly esteemed friend, Dr. Engelmann, has made several species of such forms of cerei, which are difficult to identify in the absence of flowers or fruit, on account of the great variety in the number, size, and color of spines in the same species. The spines in the plant just mentioned are angular, like those of Dr. Engelmann's Cer. enneacanthus; but they also very much resemble those of his Cer. polyacanthus. The cactaceæ can only be well characterized by their inflorescence, fruit, and general habit. Opuntia fragilis is very common in this valley, offering many varieties of shape, size, and color of the spines. Nearly all cactaceæ assume a red, shrivelled, drooping appearance at this season of the year, very different from what they exhibit when in vigorous growth. Cereus Fendleri, which is very common about the Pecos and Rio Grande, has nearly its western limit here, soon to be replaced by *Cer. Chloranthus*, an unpublished species of Dr. Engelmann. Among the shrubs peculiar to this part of the country is the beautiful and very aromatic Cowania Stansburiana. In Capt. Sitgreaves' reports, Dr. Woodhouse mentions having seen an *aromatic* Fallugia paradoxa in this region, which must be a mistake. It was this plant; for, although the fallugia and cowania somewhat resemble each other, the former is never aromatic and balsamic, like the latter. The cowania grows on much more elevated positions than the fallugia, and is considered by the Mexicans as a most valuable medicine; often selling at the rate of half a dollar an ounce, under the name of *alouseme*. It is highly esteemed as a styptic, and astringent in hæmorrhagic discharges. A beautiful blue-berried barberry (Berberis pinnata) is very common here, called by the Mexicans *leña amorilla*. This shrub is very different from the one at the Copper Mines, (*Santa Rita del Cobre*,) collected when I was on the Mexican boundary commission. The berries are very pleasant to the taste, being saccharine with a slight acidity. Fallugia, cercocarpus, and another thornless rosaceous shrub, probably a crætagus, is common along the arroyos and rough low places. The Obione canescens, and other species of the same genus, though not peculiar to this region, are met with here in great abundance. The former is called by Mexicans *chamizo*, and by our people *grease-wood*. It belongs to the tribe of chenopods, and we noticed that our sheep were very fond of browsing upon it, choosing it in preference to grass. It is an unsightly weed, with a sub-shrubby stem, but withal very useful when we could get no better material for fuel.

Section VII. *San Francisco Valley.*[1]—It is doubtful whether the name used to characterize this region is strictly proper. A part of the waters which flow southwardly into the San Francisco river, (Rio Verde,) a tributary of the Gila, and another part flowing in a westwardly direction into the Rio Colorado, are embraced in what we call the San Francisco valley. Between Leroux's springs, situated at the southwestern base of the San Francisco mountain and Cactus Pass, the western limit of this division is a space of about one hundred and sixty miles, so interesting that a volume could easily be made of the materials which are collected in it, without exhausting the subject. In general terms, we could say it was well timbered, although there were large plains situated between the hills and mountains, nearly destitute of trees.

Mounts San Francisco, Bill Williams, and Sitgreaves constitute the highest peaks of this region. They stand upon an elevated, somewhat broken plain, which is about 8,000 feet above the level of the sea. They are environed on the east and west by a large number of beatifully rounded volcanic hills, which, with the intervening forests and glades, give it the most inviting and romantic appearance we had probably seen on our route. Between this elevated plateau, extending some seventy-five miles west of Mount San Francisco, and a low range which we named the Aztec mountains, there is a wide valley, (about eighteen miles by the diagonal path in which we crossed it,) averaging some ten or fifteen miles in width. It is so densely covered with the best grama grass, that we named it "Val de China." This valley we were unable to explore except to a limited degree, for it extends northwest probably to the Colorado, and southeast to the Gila.

Partridge and Pueblo creeks, uniting in this valley from different directions, form what we suppose must be an affluent of the Rio San Francisco, constituting one of its heads and draining the valley to the south. We explored it north about forty miles, where it retained its characteristic appearance, with the exception that there seemed to be less indications of water-courses in that direction. So our attention was turned further south as the only hope of getting an easy way to the Colorado. The hills bordering this valley, especially on the west, are densely covered with cedars, pines, spruces, oaks, &c., which are sufficiently abundant to serve all the purposes of agriculture, domestic economy, and railroads. Much of the timber is of the most valuable kind, consisting of the yellow pine of this country, (Pinus brachyptera,) and the Oregon pine or Douglas spruce, (P. Douglasii,) the value of which will be more fully treated of hereafter. Besides Partridge creek, which enters this valley from the east, there is a beautiful little stream from the mountains west, entering from the opposite direction, a little further south. We named it Pueblo creek. The remains of broken pottery and the ruins of stone buildings and ancient fortifications that occur here give evidence that the country has once been inhabited by an intelligent, enterprising and warlike race of men. These remains exhibit marks of extreme antiquity.

One of the highest peaks in this range, which we named Mount Hope, is situated fifteen or twenty miles south of our explorations. It appears to be the source of the moisture of this region, and no doubt waters many such little valleys as that of the Pueblo, although we had not time to explore in that direction as far as desired.

The importance of this point is still further enhanced by the fact that from this place railroad timber, when needed, will have to be supplied westward as far as the Colorado Grande, which is distant, in a direct line, about one hundred miles; but by the route we travelled, through the valley of the Santa Maria or Bill Williams' fork, it is about one hundred and seventy miles.

My opportunities for making botanical collections in this region were about as unfavorable as on the preceding part of our journey. We passed through it from the 8th to the 31st of January. In the valley west of Aztec Pass, and between it and Cactus Pass, (25th January,) was found the first spring plant in bloom. It is one of the umbilliferous tribe, with a spindle-

[1] The name of the mountain at the head of this valley is San Francisco. The stream is usually called Rio Verde.

shaped, parsnip-like root, but much softer, sweeter, and more tender than that wholesome esculent. It is much sought after by the Mexicans, who name it *gamote*, a name that is also applied by them to the sweet potato. Mr. Leroux informed us that Indian females in this region, especially the Utahs and Pai-utes, spend much time in the early months of the year, when the root is soft and tender, in collecting it in large quantities. It is prepared by slicing, drying, and grinding on matats, and, after which, stored away for future use. They make a soup of the meal. The root becomes hard and cortical as it advances in age, and unfit to be eaten.

Besides the *grama grass*, which has been mentioned while describing the Val de China as so fine and abundant, we had a grass, peculiar to this region, called by our woodsmen "bunch grass." It was quite green, and our animals were immoderately fond of it. We were unable to secure specimens of it in flower or fruit, and therefore could not determine its name. Mr. Leroux says it is well known and prized in the great Salt Lake valley, fattening animals faster than the *grama*, but it does not afford them the same amount of strength and muscle.

A narrow filamentose-leaved Yucca was found near Picacho, and specimens of the young plants were brought home. It was not in fruit. It is quite different from the two species found east of the Rio Grande; but whether different from the one of a similar habit in Texas, can only be determined by an examination and comparison of the flower and fruit. In the waters of Partridge creek we found *Polygonum amphibium*, which, although it grows on land as well as in water, is nevertheless a sure index of the permanency of the water in its neighborhood.

In this valley we saw and collected, growing upon the piñon, a mistletoe, (*Arceuthobium*,) never before seen, and quite distinct from the one found on the other pine, (*P. brachyptera.*)

At the foot of Bill Williams' mountain, we first met the celebrated Indian Maguey, (Agave sp. undetermined.) This to the wild Indian tribes is probably one of the most important plants of the whole interior of the continent south of the 35th parallel of north latitude. It is a matter of curious interest to know how much further north it grows. We presume, however, that it will be found very little further north than our line. It flourishes on the roughest, most rocky, and apparently most inhospitable spots that can be found; and, generally, it occurs only in such places. An allied species (*Agave Americana*) is common in Mexico, and in our gardens under the title of century plant, so named from the popular notion that it blooms every hundred years. Our plant is a long time (not nearly a hundred years, however) in coming to maturity. It then blooms, bears fruit and dies, leaving many offsets which come to maturity yearly. These likewise perform their great function of fructification, and die, to give place in turn to their successors. The great value of the plant to the Indian is, that it forms a never-failing source of subsistence at all seasons of the year. At the proper season, which is about the 1st July, the stalk that bears the flower shoots up and grows with amazing rapidity. It is then very juicy, tender, and sweet, much resembling the pith of the sugar-cane; and the Indians now devote their time to preparing their *mezcal*, which will keep preserved for several months. When the time for preparing food from the flower-stock is passed, they resort to the heart or central part of the older plants that have not yet come to maturity; the most tender portions being at the base of the inner leaves. The heart can be found in different stages of development at all seasons of the year. They roast it in temporary ovens, made of earth and stones, about two days being required to cook it sufficiently. We used the juice of the plant successfully as an anti-scorbutic while on the Mexican boundary commission, my attention being first called to it by a circular from General Lawson, Surgeon General of the United States army, recommending it on the authority of Dr. Perrin, of the United States army.

Besides the trees already mentioned, we have here two or three species of cedars; one with a large, sweet, edible berry. In times of great scarcity of food, I believe this fruit is resorted to by nearly every animal in this region. Pinus edulis (piñon) grows in great abundance nearly the whole length of this district. The highlands which form spurs to the San Francisco, Bill Williams', and Sitgreaves mountains are covered with these trees; their deep green foliage

giving the forests a peculiarly dark and sombre aspect, forming a strong contrast with the surrounding grassy plains. Two very distinct species of oak occur here, one of which I have marked on the profile as *Quercus Gambellii*, of Nuttall; the other is probably new. In the deep ravines or cañons of this district we found an ash, (Fraxinus velutinus,) common also to the copper mine region, and associated with it also a cherry, which may be a new species. Willow-leaved poplar is occasionally found along the arroyos, where water has lately been standing. Among the shrubs abounding in this region are found the blue-berried barberry, a species of currant, (Ribes,) and a species of very thorny Solanaceæ, of unknown genus. A new shrub, interesting on account of its botanical affinities, was found here, belonging to the small order of Garryaceæ, natives only of western North America and the West Indies. A second species of the genus Garrya is very common about the copper mines of New Mexico, which was also detected here, but not in fruit. Which of the two, if either, is the plant of Douglas, upon which the genus was founded, we are unable at present to determine. We find great difficulty in procuring publications of American plants, in the arrangement of orders subsequent to compositæ, up to which point we have been supplied, by the indefatigable zeal and learning of those excellent co-laborers in the field of botany, Drs. Torrey and Gray, in their Flora of North America. Since the acquisition of Texas, New Mexico, and California, with their consequent explorations and discoveries, the new genera and species, in orders previously passed over, are so many and important, that a new edition is now imperatively called for, before their great work is finished.

A walnut was found in this region, collected heretofore in the region of the copper mines of New Mexico, very nearly related to the black walnut of the Eastern States. From Devil's river, in Texas, while on the boundary commission, were sent specimens and a figure of what was thought to be a new species, to Dr. Torrey, a description of which was read by him before the meeting of the American Association of the Sciences, in August, 1851, under the title of *Juglans Whippleana;* which was not published. Dr. Engelmann had previously obtained, and named it *J. ruprestris.* Dr. Torrey has published figures of both of them, in Captain Sitgreaves' report; our present plant, provisionally, a variety of that species. The differences between them, however, are greater, in my opinion, than those between the present variety and Juglans nigra; so that they may all ultimately come to be forms of one species, when still other and more closely connecting varieties are found.

A Ptelea, closely allied if not identical with the shrubby treefoil of the States, is found here. A Condalia also, which is a Rhamnaceous shrub, bearing small dark-colored berries, several species of which are eaten by Mexicans and Indians. A beautiful shrubby spiraea, or a species of some nearly allied genus, was found here.

Along the banks of Turkey creek, Pueblo creek, and the streams which we first passed after crossing Aztec Pass, we observed large quantities of willows, which is rather an unusual occurrence in this country. On the hills surrounding the Aztec mountains, for the first time, we met with the beautiful shrubby arbutus, (*Arctostaphylos,*) called by the Mexicans *manzanita;* the bark of the plant is handsomely polished, of a dark mahogany color. From this place to the Pacific, and in California, there are several species of this genus, most of them bearing an edible berry, similar to the whortleberry. In California, a most valuable timber-tree of this genus grows all along the Coast range of mountains. It bears a larger edible berry, which is much sought after by Mexicans and Indians, who know it by the name of *Madrona.* It is a beautiful tree. The wood is very hard, taking a polish equal to, and much resembling *lignum-vitæ.*

Near Bill Williams' mountain we found in considerable quantities the aggregated Cereus, noticed before; but the species cannot well be determined, on account of the want of blossom and fruit. It is very nearly allied to Dr. Engelmann's *Cereus polyacanthus,* which yields an edible fruit, called by Mexicans *pitahaya.* It is sometimes in large oval masses, densely set with formidable spines. The arborescent Opuntia, first found near Zuñi, which, to distinguish

from the true O. arborescens, we called Cacto-dendron, finds its western limits near the termination of this region. We also find here a mamillaria, very eommon, and the only one we saw between this point and the Rio Grande.

At the southern base of Bill Williams' mountain we found an Opuntia never before seen on our route, and from its peeuliar appearanee, it will doubtless prove to be a new species. It is an upright flat-jointed speeies, thickly beset with yellow spines, of a much lighter green color than most other speeies, or, indeed, any other that I have seen. Lieutenant Tidball, of our eseort, kindly sketched it for me, and provisionally named it after him, to distinguish from other allied species. *Opuntia fragilis*, and *Cer. Fendleri*, also oeeur here. There is an Opuntia in this region, very near, if not identieal with the one on the Rio Grande, with long brown spines. It is published in Plantae Fendlerianæ, by Dr. Engelmann, as *Op. phœacantha*. As we proceed westward into the neighborhood of Pieaeho and Val de China, the *O. Tidballii* beeomes mueh more frequent, and we observed that it was never found on the northern and western exposures of the hills and rocky arroyos, but mostly on the southern, (as where we first found it,) and more seldom on the eastern exposures. In Cañon ereek, the head-waters of Bill Williams' fork near the western extremity of this region, it grows seven or eight feet high, spreading so as to form an immense head, with upwards of one hundred joints, all branching from a single stalk. At Aztee Pass an Opuntia was found, whieh in the size of the joints, and appearanee of the spines, was very similar to *Opuntia Engelmanni*, but, unlike this well known species, it is spreading and prostrate. Unfortunately, we eould obtain no fruit of it.

Section VIII. *Santa Maria Valley.*—The spaee embraeed within this seetion lies between Caetus Pass and the Colorado Grande, following the eourse of Bill Williams' fork, from near its sourees, to the great river of the west. Cactus Pass is the last of the highlands that we eross before reaching the Rio Colorado. The distanee from this point, in a direet line, to the Colorado, is only about sixty miles; but by the road we travelled, through the valley of Bill Williams' fork, it is about one hundred and thirty miles.

The timber of this valley is composed almost exclusively of cotton-wood, or *alamo*, mezquite, "green-barked aeacia," of Major Emory's report, eurly mezquite, (*Strombocarpa pubescens*,) two other leguminous trees, and some willows. One of the leguminous trees is the *Olneya Tesota* of Dr. Gray, in *Plant. Nov. Thurberianae*, pages 313 and 328.—1854. It was eolleeted by Mr. Thurber on the Gila. It has very mueh the habit of a Robinia. The foliage of the tree is very dense and heavy, and although dark green, the leaves were sometimes erisped as though they had been bitten by frost; yet there were no evidenees of frost on other tender vegetables in its vieinity. Our Mexieans were not aequainted with it, nor with the name *Tesota*. The alamos grow to a good large size, and are quite abundant. The two mezquites are rather small in this valley, seldom attaining more than fifteen or twenty feet in height. The *Tesota*, "green-barked aeaeia," and the other leguminous tree, grow fully as large as the mezquites, and in an eeonomieal respeet, it is presumed, will prove equally useful for domestie purposes. Although willows in many places grow quite large and abundantly, yet, for anything but browsing animals in times of great scareity of grass, and for fire-wood, they appear to be nearly useless.

Grass in the upper portions of this valley is quite good, and suffieient to support considerable numbers of mules and stoek in passing through. But in the lower portions, as we approaeh the Rio Colorado, grass of all kinds beeomes quite searee; mules then resort to the twigs of the willow, and the twigs and bark of the alamo, upon whieh they have been known to subsist the whole winter.

The water of Bill Williams' fork, in many plaees, flows in a bold current; but, like the Mimbres, and other streams in this country, it sinks again in the sand, sometimes within a very short distanee of its head. It rises and sinks this way, alternately, until it reaches the Rio Colorado. This valley, which is generally narrow, eannot be worth much for agrieultural purposes; yet there are several places where it widens, so as to form very pretty sites for settle-

ments. We passed through this valley from the 1st to the 20th February, when the weather was warm and genial, as in the month of May in the Atlantic States.

The seasons appear to be two or three weeks earlier here than at the Mojave village in the Colorado valley. We were unable to determine from observation whether the soil here can be cultivated without irrigation, because we had not time to make any experiments on this subject in our rapid reconnoissance. From the fact that the Mojave Indians, but a short distance further west in the Colorado valley, cultivate corn, wheat, beans, pumpkins, melons, and probably other culinary vegetables, without irrigation, one can have little doubt but that the same may be done also in this valley. Should this prove to be true, there are several places, especially in the vicinity of White Cliff creek, which will be of great importance on this account. The valley here spreads out to quite a wide space, and is, moreover, convenient to good timber near Aztec Pass, besides the cotton-wood and mezquite in its own immediate valley.

This may emphatically be called the region of Cacti of our route. One of the first of them that we found after entering this valley was the *Echinocactus Wislizeni* of Dr. Engelmann, called by the Mexicans "visnada," the juice of which is said to serve as a substitute for water when it cannot otherwise be procured. Instances have been known among the white trappers of this wild region, where the lives of men have been saved by this plant. On the morning of February 3, we found one of them left by the Yampai Indians, who had been on the ground the previous night. The spines were burned, and two-thirds of the inside were scooped out so as to form a sort of kettle. Mr. Leroux informed us that they scoop a space of its centre, introduce other vegetables, and with the introduction of heated stones cook the whole together. These vegetable boilers are not transported from one camp to the other, but, on account of their abundance, new ones are formed at every camping ground where they are required. A Cereus was recognised to-day, very nearly akin, if not the same, as one that is very common around El Paso, (*Cer. chloranthus Engl. ined.*,) and heretofore only known in that region. We were unable to get its flower or fruit to compare with the El Paso plant, which was much to be regretted, as the spines of these plants vary so much as to form by themselves but poor distinctive characteristics of the species. There also was found a globose mamillaria, with from one to three or four central-hooked spines. It differs from the one collected on the Pecos, by its red clavate fruit. We noticed also a new arborescent opuntia, very nearly allied to *O. arborescens*, the last of which we saw at the ruins near the Pueblo de Zuñi. This plant differs from that in having spiney fruit and a larger seed, but in other respects it resembles it very much. The beautiful scarlet-berried *Op. frutescens* was found in this region. It was collected also at Laguna Colorado, sixty miles east of the Rio Pecos, showing it to have a wider geographical range than the *O. arborescens*, which is supposed by Dr. Engelmann to be the widest diffused of all North American cacti. In addition to those already mentioned, we gathered a beautiful Opuntia, common in this region and quite different from any we had heretofore seen. It is a flat-jointed, spineless variety, growing in a handsome rosette manner, and covered with a beautiful velvety bloom or pubescence. The minute barbed bristles of the pulvilli are very annoying when handled. It is even said to be destructive to the eye if permitted to touch that delicate organ.

By far the most interesting cactus of this region, and probably of the whole world, is the *Cereus giganteus*. We saw it for the first time, in this valley, on the 4th of February, growing about forty-five feet high; but along the valley of the Gila, it is said to reach sixty feet in height. It frequently occurs from twenty-five to thirty feet high without a single branch. Among the skeletons of wood, after the fleshy parts of the plant had decayed and fallen away, we observed in the old trees a perfect net-work of the bundles of woody fibres, reticulated on a large scale, exactly after the manner of the woody fibres of the *Opuntia arborescens*. Our observations do not accord fully with the account given by Drs. Engelmann and Parry,[1] who had

[1] Silliman's Amer. Jour. of Science and Arts, Vol. XIV, Nov., 1852.

probably taken their description from younger plants, before the interlacing or anastomosing process had been carried to any considerable extent. We have seen the skeletons of young plants which exactly corresponded with their description. The fruits of many Cerei are edible, with something of the flavor and shape of a large gooseberry. They are thickly covered with sharp spines; but as soon as the fruit ripens, these can be brushed off with ease. By peeling the rind, there is left a large, sweet, delicate pulp, that will rival any gooseberry. The top of this giant Cactus, however, yields a *pitahaya*, far sweeter and more delicious than those which grow on more humble stems. The Indians collect large quantities of it by tying a fork to the little end of a long willow pole, which enables them to reach and bring down the fruit without injuring it. They make a syrup, or conserve, from the juice, which serves them for luxury, as well as for sustenance, and which can be preserved a long time. The Mexicans call the tree "suwarrow;" the Indian, "harsee;" and the syrup manufactured from the juice, "sistor." The juice of the flesh of the tree is quite bitter.

We find (February 7) a new species of Opuntia, with a reticulated woody stem, very fragile at the joints before hardening into wood, and armed with spines worse than those of a porcupine. It is called by the Mexicans, "chug." The plant is the horror of man and beast. Our mules are as fearful of it as ourselves. The barbed spines stick so fast in the flesh that the joint of the plant is separated from the main stem before the spines can be withdrawn. We found this species sometimes ten and twelve feet high, branching very fantastically, in consequence of the fragility and decay of the younger stems and joints. In a landscape by Mr. Stanley, (plate 16 of Major Emory's report,) in the foreground is the figure of a cactus, of which, in the text, no account is given. It has a faint resemblance to our plant; but Lieutenant Whipple, who has travelled and explored much in that region, is pretty confident that it represents a different species, which he has also seen. The figure is too regular in its outlines and curves to represent the peculiarly angled and irregular appearance of our plant. It is, without doubt, an undescribed species. We find here what is supposed to be *Opuntia ramossissima* of Dr. Engelmann, collected on the desert between the Colorado and San Diego by Dr. Parry. In places favorable for its growth, it is found six feet high, as robust and tree-like as the *O. arborescens* itself.

The fact that on the 7th February we collected a Draba, a Thelopodium, and a Vesicaria in full bloom, is a proof of the forwardness of the season in this valley. February 11th we collected, along the banks of Bill Williams' fork, fine specimens of a Lepidium and a Hosackia.

Section IX. *Valley of the Colorado.*—From the mouth of Bill Williams' fork to the point above where we crossed the Rio Colorado, is about sixty miles; and from thence to Soda lake, on the Mojave creek, where, at ordinary seasons of the year, water is first found, is about one hundred miles further west. Along the valley of this river, alamo, mezquite, and willow form the principal, and almost entire, kinds of trees. The Mojave Indians make use of willow twigs in the formation of their granaries, where they store away the fruit of the *Tornillo*, (curly mezquite,) and various other vegetable products, for winter consumption, or for times of scarcity. Their depositories are built in a circular form, four or five feet high, and about the same, or a little less, in diameter. After being filled with their stores, they are covered with willow bushes or reeds, over which is laid another cover of earth. The climate is so dry, they find no difficulty in thus preserving their winter grain. We passed their villages the last days of February, and found them in the possession of plenty of corn, wheat, beans, pumpkins, &c., which they gladly traded for our old worn-out clothes. They brought us one watermelon that had been preserved from last year. We travelled about sixty miles through their territory without seeing any appearance of irrigation, from which we may safely infer that they cultivate their crops without having recourse to this process. There can be no doubt, however, but that it would add very materially to the amount of agricultural productions, if irrigation were employed.

Very little grass is to be seen in this valley. Our sheep ate readily of the *Obione canescens*, (grease-wood,) which grows abundantly throughout this whole region. Our mules were very

fond of an aromatic shrub, of quite a low stature, which grows in considerable quantities on the gravelly ridges of both sides of the Colorado. It had shed its seed, but, accidentally, a few poor specimens were found—enough to determine it to belong to ambrosiæ, a sub-division of compositæ. Of this tribe there are in the Eastern States several species, of which cattle and horses are very fond.

The value of the Colorado valley, in affording subsistence to a civilized population, was considered nearly equal to that of the Rio Grande valley, which, in some respects, it a good deal resembles. The soil is better adapted to the cultivation of cereals than that of the Rio Grande, where it can only be done by the assistance of irrigation, which, in this country, is a costly process.

On leaving the valley of the Colorado, we ascended very rapidly about four thousand feet above the level of the sea, where the change of climate is very strongly marked. At the Colorado it is very warm and summer-like, while at our camp (6th March) on the northern slopes of the hills and in deep ravines there was snow. Here we met with cedar (Juniperus occidentalis) and pine, (Pinus edulis,) which, however, only greet the eye but a short distance. It may be possible that the New Mexican yellow pine (*Pinus brachyptera*) will be found in still higher points of this range in this neighborhood, but, on account of our necessarily rapid movements, we had not time to determine. In addition to the trees already mentioned, we noticed here vast quantities of the tree Yucca, called by the Mexicans *Palma*. It was seen before on Bill Williams' fork, but it is found here from twenty-five to thirty-five feet in height, and eighteen inches or two feet in diameter, with a bark on the lower part of the trunk very much resembling that of white oak. Although not good for fuel, we were sometimes under the necessity of resorting to it for camping purposes. Besides these, we saw here a variety of shrubs, the principal of which are two species of Rhus, (one of which I had never before seen,) blue-berried Berberis, Cowania Stansburiana, Fallugia paradoxa, Shrubby artemisia, Obione, and a shrubby Amygdalus or Cerasus, which very much resembles one common on Devil's river, in lower Texas. A species of Chilopsis, a bignoniaceous shrub, or small tree, with beautiful large flowers, much resembling those of a Catalpa, is frequently found in the dry ravines here, as also all over the western wilds. An undetermined species of Lycium, a solanaceous shrub, with an edible berry, was also collected here.

Besides some new cactaceæ, which will be mentioned soon, we found here several species, supposed to be peculiar to the Rio Grande valley; among them are Opuntia clavata and O. fragilis. A flat-jointed Opuntia, with long brown spines, collected before as far back as the Llano Estacado, which was considered very near *Op. phœacantha* of the Rio Grande valley, was also found on this part of our route. Also an aggregate Cereus, which cannot be distinguished, in the absence of flower and fruit, from allied species on the Rio Grande. Besides the *Echinocactus Wislizeni*, which is quite common here, we found a new species of the same genus, aggregated in large globose or ovate heads.

The fruit is crowned with the dry flower, and is thickly covered with a whitish wool; the scales are lanceolate-subulate; and the seeds pyriform, black, and rugose. The aggregated form of this plant is peculiar, and an exception to the general habit of the genus. It had already passed flowering, (March 2d,) and matured its fruit.

After crossing the dividing ridge between the Rio Colorado and Mojave creek, we saw the celebrated, but totally useless, *Larrea Mexicana*, or creosote plant, giving the surrounding scenery a most beautiful and verdant appearance. This plant is one of the most repulsive that can well be imagined. It is the surest indication of a sterile, worthless soil that can be found in the vegetable kingdom; for wherever it flourishes, little else can be found.

Section X. *Mojave Valley.*—This region extends from Soda lake to Cajon Pass, a distance of about one hundred and thirty miles. With the exception of the last twenty-five miles, it is entirely along the Mojave creek. There are beautiful grassy plains in this valley, within reach of clear, sweet, running water, where, we were told, it was a great grazing resort for those

mules, horses, and cattle, preparatory to crossing the desert of a part of the Salt Lake valley; before the California gold excitement, animals were sent from the valley of Los Angeles, and its vicinity, to Santa Fé, with profitable returns. Large herds were annually brought out to this place and grazed for that purpose. Since the revolution, stock of all kinds is in great demand, at very high rates, in California; and New Mexico, in her turn, now sends out large flocks of sheep, to supply, in part, those demands. Sometimes they are sent by the way of Salt Lake valley, and from thence, up this valley, to California. After crossing the desert of Salt Lake valley, they are generally permitted to stop here, and at the Cajon to recruit, so as to render them saleable on arriving at the settlements of California. At other times they are sent by the way of the valley of the Gila, and thence across the desert to San Diego. Our route is much more direct than either of the others, and better, too, if we may judge from our own explorations and the accounts of travellers. The enterprising Captain Aubrey would have taken his sheep over this route the present season, but for the hostility of the Mojave and other tribes of Indians who infest this region.

The stream of the Mojave is not continuous, but sinks and rises every few miles, after the manner of Bill Williams' fork, and the Rio Mimbres, in New Mexico. In some places the stream is large and bold, running with a swift current, like the Mimbres. The soil in the widened valleys is rich, and appears to be capable of cultivation without irrigation. In such case it will make a valuable territory, well suited to settlements and military posts.

The timber of the valley is much like that of the Colorado, consisting of cotton-wood, (*Populus monilifera*,) mezquite, (*Algarobia glandulosa*,) curly mezquite, (*Strombocarpa pubescens*,) and willow, (*Salix*,) of several species. On arriving at the Cajon Pass, two kinds of cedars occur; pines, three or four kinds—Oregon pine, (*Pinus Douglassii*,) piñon, or nut pine, (*P. monophylla, Torr.;*) and on the neighboring mountains, the sugar pine, (*P. Lambertiana*,) and one other species, somewhat resembling, but different from, the New Mexican yellow pine. All of these occur in great abundance, and of the best quality. Immediately on passing the crest of the Cajon, the vegetation changes like magic. Many of the shrubs being such as we had never before seen, the mountains and hills were covered and green with their perennial foliage. Among the most beautiful we found several species of Ceonothus, (represented at home chiefly by the New Jersey tea,) ornamented with bright, cerulean blue flowers, in charming contrast with the leafless waste that we had just left. We collected at this place specimens of the new remarkable genus *Fremontia*, which is described and figured in *Plantæ Fremontianæ*, (*p.* 6, *pl.* 2: 1850,) by Dr. Torrey. The whole tree has very much the habit of Hibiscus syriacus, or common Althea shrub; but, according to Dr. Torrey, it belongs to the family of Bombaceæ, and is very closely allied to the celebrated hand-tree of Mexico, (*Cheirostemon of Humboldt.*) A species of Yucca, different from the five or six other Texan and New Mexican species that we had seen before, was collected at this place. A beautiful evergreen oak, with very large cups and acorns, was first found at this pass. Not having proper books of reference at hand, it is impossible at this time to determine the species. But the acorn is the one on which the *Digger Indians*, of California, are known to subsist for a great portion of the year. When standing in an open space, it forms one of the most beautiful and graceful trees of the forest.

The Cactus tribe in this valley is not so plentiful in species or numbers as in some of the regions just described; yet we found an Echinocactus here that had not been seen before. It may be the *E. viridescens, Nutt. Var? cylindraceus*, collected by Dr. Parry "near San Felipe, on the eastern slope of the California mountains;" but in the absence of the fruit, or flower, or even a good description of the original plant itself, it is impossible to decide with certainty. Dr. Engelmann's *Mamillaria tetrancistra*, collected by Dr. Parry on the desert between San Diego and the junction of the Gila with the Colorado, was collected here, as also on Bill Williams' fork; but the long, hooked central spines vary from one to four in number.

Section XI. *Los Angeles Valley.*—From Cajon Pass to the sea, at San Pedro, is a distance of about eighty miles through a beautiful valley, requiring very little description, in consequence

of its having been long known. It was first settled by the Spaniards soon after the discovery of this part of the continent. It is well wooded and watered. We had not time to examine the timber of the mountains in this vicinity on account of our hasty march. In the preceding portion of our route we mentioned the trees seen at Cajon Pass; and as we passed down Cajon creek we saw the California sycamore, (*Platanus Mexicanus*,) alder, (*Alnus*,) of quite a respectable size, and cotton-wood; and as we proceeded on to the plains there were collected two other species of oaks which grew in great abundance; neither of them in fruit, however, at the time we passed. The base of the mountains to our right was covered with this timber.

Grass and wild oats are abundant in the valley from one end to the other. Nature has peculiarly favored this region, and adapted it to grazing, by furnishing it with a succession of plants, which come on in regular succession; so that no trouble or expense is experienced in raising cattle and horses, except for salting and keeping them tame. The first crop is called "pin-grass," (*Erodium cicutarium*,) belonging to the family of *Geraniaceæ;* the next is a crop of leguminous plants, such as Medicago, and several species of clover, (*Trifolium*,) which spring up one after another; then follow wild oats (*Avena*) and other species of grass in great abundance.

At the Cajon valley there are several species of cactaceæ, both flat-jointed and cylindrical, with a woody axis, which are somewhat different from those passed in the Colorado valley.

At Cocomungo, in this valley, we found vast and dense patches of an Opuntia, nearly akin to *O. Engelmanni*, which had the appearance of having been introduced; but whether it really is so, cannot be determined. The Spanish *Tuna*, (*Opuntia Tuna*,) which is cultivated for its fruit, forms hedges fifteen or twenty feet high. The Indians and Mexicans are very fond of the fruit, which serves them for food during its season.

At the mission of San Gabriel we saw large orchards of orange trees laden with its golden fruit, which ripens perfectly in the open air, (22d May.) We could say nothing more favorable of the climate of this delightful region. There are many other exotic plants that would succeed with very little trouble; the tea plant especially we think would do well, and deserves a thorough trial. The grapes cultivated here are said to be equal to any in the world.

No. 2.

DESCRIPTION OF FOREST TREES.

BY J. M. BIGELOW, M. D.

PINUS (Abies) DOUGLASII.—*Douglas Spruce*, or called simply *Spruce* in some regions; *Oregon Pine* about *San Francisco;* and *Hemlock* in other places.

The first place on the route where it is found is on the Sandia mountains, east of the Rio Grande, and between it and the Rio Pecos. It grows there abundantly. It next occurs on what is called the Sierra Madre, about ninety miles west of the Rio Grande, and is there also quite abundant. We again observed it, but rather sparingly, in the mountains around Zuñi.

After crossing the Rio Colorado Chiquito we come to a range of mountains, of which the most elevated and prominent peaks, near where we passed, were San Francisco, Bill Williams, and Mount Sitgreaves. Here was a belt of forty-five miles or more in width, stretching in a southeasterly direction to the Mogoyon or Sierra Blanca, probably as far as the headwaters of the Gila. At the Copper Mines, near the Gila, I found it in abundance in 1851, as well as at the Organ mountains, near Doña Ana, while connected with the Mexican boundary survey. At Aztec Pass, one hundred miles west of San Francisco, it is found again, but not so abundantly as at the latter mountain. As soon as we reached the Sierra Nevada, and along the whole Coast range as far as Los Angeles, it showed itself in the greatest abundance. It grows also in almost every mountainous region of California, from the coast to the highest range of the Sierra Nevada. On the mountains of the Sierra Madre, east and west of the Rio Grande, at San Francisco and its vicinity near the two Colorados, at the Organ mountains and those of the Mimbres near the Copper Mines, this tree grows from ninety to one hundred and twenty feet in height, and from three to six feet in diameter. In California it is found of a much larger size, frequently attaining the height of two hundred feet or more, and from six to nine feet in diameter. The wood is coarse-grained, tough, and hard—so much so as to preclude its being used as pine lumber; but it forms most excellent building timber. At San Francisco, Sacramento, and other cities of California, this timber is used almost exclusively for making plank-roads, side-walks, and piling. Probably one-fourth of the city of San Francisco is thus built on piles, driven from ten to fifteen feet into the ground. The wharves at the latter place are built exclusively of this timber.

From its abundance and widely-extended range, it will be seen that this tree will form one of the most valuable timber products of the proposed line; and, from what I have seen of its applicability to purposes of this kind, I have no hesitation in affirming that it will make railroad ties, equal, if not superior, to those of any other wood in the West. This tree has been well characterized, and a good figure of the fruit, cone, and branch given in Hooker's Flor. Boreali Americana.

PINUS (Abies) BALSAMEA.—Common name *Balsam*, or *Balsam Fir*.

It is identical with the one growing in the eastern States in such abundance. We found it only on the more elevated points of the Sandia, San Francisco, and Sierra Nevada mountains. It was not seen by us at the Cajon Pass of the Sierra Nevada, but I have no doubt it exists on the more elevated peaks of that region. Near Sonora and Downieville, in California, it grows to a great height, equalling that of the sugar and yellow pines. It forms a beautiful tree; but, from the perishable nature of the wood, it can scarcely be used for railroad purposes, except in places where it is protected from the disorganizing influences of the weather. The process of kyanization would probably have the effect to render it more valuable. It is an old and well-known species. In places where it abounds it is used for various building purposes, where not exposed to the weather, for which it is admirably adapted by its straight axis and beautiful taper. The balsam, which is an exudation from the bark, is medicinal, and held in high esteem as a remedy for burns and various other diseases.

PINUS BRACHYPTERA.—Called *Yellow Pine* in some regions, and *Pitch Pine* in others.

This is quite a different tree from either of the pines so called in the Eastern States. It is very common all over New Mexico and California. This tree is most generally associated with Douglas spruce, first making its appearance on the mountains between the Pecos and the Rio Grande. It grows abundantly about Santa Fé, in New Mexico, and was described first by Dr. Engelmann, from specimens collected by Dr. Wislizenus. Dr. Torrey (Report of Sitgreaves' Expedition, p. 173) mentions that Dr. Engelmann's *P. Macrophylla* was found at the Zuñi mountains. He says, however, it does not agree well with Engelmann's description. We found only this one so common in all that region, and suspect it is the one to which he has reference. It occurs at the Sandia and Organ mountains, east of the Rio Grande, at the Mimbres mountains, Sierra Mogoyon, San Francisco, Aztec Pass, and on the Sierra Nevada, near Mount San Bernardino. In every region of California, also, where the Douglas spruce is known to exist, this tree grows. I think, however, that it is found more abundantly in the interior of California, along the spurs and heights of the Sierra Nevada, than along the Coast range, where the Douglas spruce is the most abundant. In all these places it forms a beautiful timber tree. East of the Sierra Nevada it rises to the height of one hundred feet, with a diameter of five or six feet. On the western slopes of the Sierra Nevada, like the spruce and other pines, it grows much larger and taller. In favorable situations, it equals in height the other pines of those regions.

The wood of this tree is soft and easily worked, and varieties of it are equal in beauty and utility to the wood of any other pine. About Santa Fé, Albuquerque, Anton Chico, San Miguel, and all the towns on the upper Rio Grande, and Pecos, it forms their principal lumber. It exists so abundantly on the Mimbres, the Organ mountains, and on the mountains further east, bordering the Pecos, as to supply San Elizario, El Paso, Doña Ana, and all the lower towns of the Rio Grande, with lumber. It is also used in every part of California for building and other domestic purposes. On account of the softness of the wood, it is thought it would not answer as well for railroad ties as the Douglas spruce. The accompanying profile, on which I have attempted to illustrate the relative ranges of these trees above the level of the sea, approximates pretty nearly the truth. Although the range of this pine is very intimately associated with the Douglas spruce, yet, on reference to the profile, we shall see that it is found at a greater altitude, although the two species frequently overlap each other on the sides of mountain slopes. The Douglas spruce occupies the lower, and this species the upper portions of the mountain chains.

I am not aware that a good figure of this tree has ever been made. It was first brought to the notice of botanists and the public by Dr. Engelmann, in Wislizenus' Report, in 1848.

PINUS EDULIS.—Called *Piñon* by the Mexicans; *Nut Pine of New Mexico*, by Americans. The fruit of it is called by Mexicans *Piñones*.

In every place, from the bluffs of the Llano Estacado, about one hundred and sixty miles east of the Rio Pecos, to the Cajon Pass of the Sierra Nevada, this tree is found to be closely associated with cedars. It seldom grows large. A little west of the San Francisco mountain, and at the Cajon, it is found from forty to fifty feet high, but further east it seldom attains more than twenty-four. Its usual height, however, is about thirty feet. The timber is seldom used for domestic purposes, and I am, therefore, unable to express an opinion of its fitness for railroad lumber. The wood is tough and elastic, but with regard to its durability when exposed to the vicissitudes of the weather, I am unable to give an opinion.

From its extensive diffusion along the route, it would be of great value should it prove durable, for in other respects it would be well adapted to railroad purposes. On the other hand, should it be subject to early decay, I have no doubt but that subjecting it to the process of kyanization, as resorted to in the English railroad system, would obviate the difficulty, and prove with us, as with them, more economical in the end, although rather expensive at first. This might be the case even with our more durable species.

Its range of elevation above the sea-level is wider, and it is more extensively diffused than the species before mentioned. I have not seen it, however, on the western slopes of the Sierra Nevada above Los Angeles, nor in the upper portions of California.

The nut is sweet and edible, about the size of a hazel-nut. It is used as an article of trade by the New Mexicans of the upper Rio Grande with those below, and about El Paso. The fruit has a slightly terebinthine taste; but the New Mexicans are very fond of it. When it is considered how expensive it is to cultivate corn in those arid regions, where irrigation is necessary, one would naturally infer that an oil-nut as easily and abundantly produced as the piñon, would be an article of the first importance; and I have no doubt such will be the case when the country comes to be occupied by an enterprising and intelligent race. In the fattening of swine, this tree would receive a share of public attention. Bears and other animals, in large numbers, are known to subsist upon the fruit in those regions.

Dr. Engelmann (Bot. Sketch, Wislizenus' Report, p. 4, 1848) gave a description of this tree under the name used above, and Dr. Torrey (Sitgreaves' Report, Pl. 20) has given an excellent figure of the same. Three years previously, Dr. Torrey (Report Fremont's Exploring Expedition, p. 319, 1845) described and figured a species of pine under the name of P. MONOPHYLLUS, or the *Nut Pine of California*, which, according to Fremont, is "extensively diffused over the mountains of northern California, from longitude 111° to 120°, and through a considerable range of latitude." Dr. Engelmann, in the work previously referred to, describes another closely allied species under the title of *P. osteosperma*, the *Nut Pine of northeastern Mexico*, collected by Dr. Gregg on the battle-field of Buena Vista, with the remark, that the "cone and seeds are similar to both others," *i. e.*, *P. edulis* and *P. monophyllus*. A comparison of the two figures of Dr. Torrey, in Fremont's and Sitgreaves' Reports, will hardly fail to convince the most skeptical that they are varieties of one species;[1] and consequently, Dr. Torrey's name having the priority, will have to be retained and adopted. The principal characteristics of the three species being in the number of leaves in the sheaths, varying from one to three, they fail to be distinctive marks. In Dr. Engelmann's two species, the leaves are exactly alike in both; the only difference being in the hard and soft shell, which is scarcely sufficient for a specific separation. Indeed, the California specimens I found at the Cajon had a testa as hard as that of Dr. Engelmann's Mexican species; a fact also observed by Mr. Leroux with regard to the nut pine north of our line, on the Sierra Nevada mountains, about Walker's and Fremont's Passes. The extent of the eastern and western range of Fremont's plant is 9°

[1] See Dr. Torrey's remarks on *P. edulis*, in the Botanical Report of the Expedition.

of longitude. Mine extends from the Llano, 103°, to the Cajon, 118°, a range of 15°. I have also seen it south as far as the mountains of the Limpia, in about latitude 31° ; and Dr. Parry has collected it still further south, in the cañons of the Rio Grande, below Presidio del Norte.

PINUS FLEXILIS.—*Rocky Mountain White Pine.*

We found this tree at the Sandia mountains of New Mexico, at an elevation of about 12,000 feet above the level of the sea. Dr. Engelmann observes, that it was collected about Santa Fé by Mr. Fendler. In its cones and habit it is closely allied to *Pinus strobus*, which is the white or Weymouth pine of the North and East. On the authority of Dr. James, who first discovered this species, it is asserted that the seeds are large and edible. The piñones in use about Santa Fé, however, Dr. Engelmann remarks, are the produce of the *P. edulis*.

At an elevation of the San Francisco mountain nearly equal that of the Sandia mountain, it was found again forming a large and beautiful tree one hundred to one hundred and thirty feet in height. These are the only two localities on our route where this pine was detected. I was not high enough on any of the points of the Sierra Nevada to know whether it grows there ; but at the proper elevation, there can be little doubt that it may be found there also.

With the quality of its wood, either for lumber or for railroad ties, I am entirely unacquainted ; but from its close affinity (as before intimated) with the Weymouth pine, which is a most valuable species, I have no doubt this tree will yet prove to be one of the most important on our route.

JUNIPERUS VIRGINIANA.—*Red Cedar.*

In places along the Canadian river, near Sans Bois creek, and even as far west as Old Fort Arbuckle, this tree grows quite large, and in abundance. Large specimens of it, however, were not seen further west. Although it would be as durable as almost any other timber that could be procured, yet it is said to be too brittle for railroad ties.

On the bluffs of the Llano Estacado, and from that point west as far as the Cajon Pass, occur in many places, and sometimes in great abundance, two or three other species of cedar. Of a collection made by Dr. Woodhouse, Dr. Torrey, in the "Report of an Expedition down the Zuñi and Colorado rivers, by Captain Sitgreaves," observes "that one may be *Juniperus occidentalis*, (*Hook*,) the second *J. tetragona*, (*Schlect.*,) while the third is probably new." Mine are probably all included in his list ; and if so excellent a botanist as Dr. Torrey is in doubt in reference to the species and varieties of these plants, it would be folly in me to attempt to reduce or determine them.

The trunks of the western varieties are too short to render them of much value for timber. The berries of most of them (especially those of *J. occidentalis*, which has a large, slightly tuberculate fruit) are sweet and nutritious, affording sustenance to bears, wolves, and a variety of other animals, if not the Indian himself.

ALGAROBIA GLANDULOSA.—*Mezquit.*

Trees of this species are found considerably east of the Pecos and Rio Grande valleys, but mostly in a shrubby state. In the valleys of the Colorado Chiquito, San Maria, Colorado Grande, and Mojave, this tree grows to a considerable size. In Southwestern Texas and in the eastern regions of Mexico it is considered invaluable from its extreme durability. Fences made of this timber in that part of Texas have been known to stand in a perfect state of preservation more than fifty years. From its hardness and durability, there can be no doubt but that it would make ties equal to the lignumvitæ of tropical climates ; to which it is, indeed, closely allied botanically, belonging to the section Mimoseæ of leguminous plants.

Besides the STROMBOCARPA PUBESCENS, (Mexican *tornillo*,) a genus closely allied to Algarobia,

there are other trees of this order abounding along the valley of Bill Williams' fork, attaining the size of the mezquit; but I have not had an opportunity of determining their names. One of them is described by Major Emory, in his report, as the "Green-bark Acacia." An interesting fact respecting this tree is, that it forms a shelter for the propagation of the *Cereus giganteus* of that region. Every young cereus is protected and fostered by this tree until the cactus attains the size and hardihood that enables it to withstand the war of elements waged against it, when it ungraciously spurns its protector, ultimately destroying it, as we saw in numerous instances on our journey.

POPULUS MONILIFERA—in Spanish, *Alamo.—Cotton-wood.—Poplar.*

This tree is somewhat different from the cotton-wood of the Mississippi, which I believe is *P. angulata*. It is found east as far as the Canadian, and west until we cross the Sierra Nevada. In the Rio Grande valley it is used by the Mexicans for building. It is also employed for farming utensils, the most unique of which is their cart, or *caretta*, the wheels being made of a section of the tree. They are six or eight inches thick, and manufactured in the rudest manner. The timber is tough and hard; and although probably not as durable when exposed to the weather as some other kinds, yet I have no doubt it would answer very well for railroad ties, until a road could be formed to regions where more desirable timbers abound. It does not grow here near as tall as on the Mississippi river, but occasionally it is quite large and spreading.

QUERCUS.

Of the valuable genus of *Oaks*, we find about Fort Smith, and west as far as the Cross Timbers, all the varieties that are common to the more eastern States, all of which are well known. Besides the several species mentioned by Dr. Torrey, in Captain Sitgreaves' Report, most of which are doubtless in my collection, we found, at the Cajon Pass of the Sierra Nevada, a live-oak with a cupule an inch or an inch and a half in diameter. It is a beautiful and valuable timber tree, and doubtless it is a well-known Californian oak. It grows in various parts of California; but how widely it is diffused, I am unable to determine. It attains the height of eighty to one hundred feet, and is from two to four feet in diameter. The timber, from the character of the tree, must be valuable.

DESCRIPTIONS OF VALUABLE OR REMARKABLE CALIFORNIA FOREST TREES.

PINUS LAMBERTIANA, OR SUGAR-PINE.

This is one of the most magnificent pines of the Sierra Nevada. We first noticed its appearance at San Bernardino, not far from San Diego; and it probably follows the course of the Sierra Nevada to Oregon. At Sonora, Mokelumne Hill, Nevada City, Downieville, and every place where I visited those mountains, at an elevation of 4,000 or 5,000 feet above the level of the sea, this noble tree is found in perfection. It ordinarily attains the height of two hundred feet, and is six to ten feet in diameter. It is very symmetrical and beautiful in shape, with a slender but graceful foliage, in which characters it probably exceeds every other pine tree of California. It forms a timber equal to that of any other in the world. Its grain is so straight and even, that thousands of houses in California are weather-boarded with shingles, which are merely split, without any other expense or work. There are many mills in the vicinity of Downieville, Nevada City, Grass Valley, and Sonora, where lumber is manufactured and planed, by means of machinery, in quantities sufficient to supply vast regions in that country. Were it not that transportation is so expensive in California, the rapidly-increasing cities of San Francisco, Sacramento, and all the coast region could be supplied with lumber of a quality far superior to that brought from Oregon, with which their markets are now mainly furnished.

Professor Lindley (Vegetable Kingdom, page 228) observes of this tree and *Abies Douglasii*, that "they are probably the most valuable fir timbers of the whole family." And it will be remembered, the pine tribe stands at the head of the list of timber trees.

Wellingtonia gigantea.

This tree is popularly known, in the district where it grows, as the "*Mammoth Washington Tree.*" At this time it probably possesses more interest than any other American tree. Our backwoodsmen have known of its existence ever since the beginning of the California gold excitement, for it grows very near a rich auriferous region, about equidistant from Sonora and Mokelumne Hill, both of which districts are much resorted to by emigrants and gold-seekers. The so-called Mammoth Grove is north of those places, near the head-waters of Calaveras and Mokelumne rivers. Dr. Randall, the worthy president of the California Academy of Natural Sciences, had his attention called to the tree several years ago, and was persuaded it possessed characters generically distinct from the redwood, (*Sequoia sempervirens,*) and sent, more than eighteen months ago, large and beautiful specimens of this tree, besides many other rare and new botanical specimens, to Drs. Torrey and Gray. Most unfortunately, the specimens were lost in the transit of the isthmus. Doubly unfortunate has it happened to us as *Americans*, because we have been anticipated, and prevented from giving it a proud American name, the Washingtonia. Dr. Randall and his friends, being convinced of its being the type of a new genus, proposed to call it after our revered Washington, but not having books of reference at hand, he sent specimens (which, as before stated, were lost) to Drs. Torrey and Gray, for the purpose of having the tree described and published. In the mean time, Mr. Lobb, a seed collector for some society in Scotland, sent home enough to characterize the plant, which was done by Professor Lindley, in the London Gardeners' Chronicle. However, we must now be contented with the possession of the tree, as England must be with the empty name. From recent researches of Dr. Torry, I believe he is pretty well satisfied that this tree is not generically distinct from the redwood, and has bestowed on it the name of Sequoia gigantea. A good generic character of this family is contained in the staminate flowers and stamens; and when these are procured and examined, this question can be satisfactorily settled.

As considerable discussion has already been had with regard to the age of this tree, I may state, that when I visited it in May last, at a section of it eighteen feet from the stump, it was fourteen and a half feet in diameter. As the diminution of the size of the annual rings of growth, from the heart or centre, to the circumference or sapwood, appeared to be pretty regular, I placed my hand midway, roughly measuring six inches, and carefully counted the rings on that space, which numbered one hundred and thirty, making the tree 1,885 years old. Since I came home, Dr. Torrey tells me he has actually counted every ring of a section of the tree, and found the number a little over 1,100. This makes a great discrepancy with Professor Lindley's account in the Gardeners' Chronicle, where it is estimated at more than 3,000 years. I believe it is asserted in the Chronicle that it must have germinated when Moses was a little boy!

A verbal or written description of the size of this tree, however accurate, cannot give one an adequate idea of its dimensions. It required thirty-one of my paces (of three feet each) to measure thus rudely its circumference at the stump. The only way it could be felled was by boring repeatedly with pump augers. It required five men twenty-two days to perform the operation. After they had succeeded in severing it at the stump, the shoulders were so broad, and the tree so perfectly equipoised, that it took the same five men two days in driving wedges with a battering-ram on one side of the cut, to throw it out of its equilibrium sufficiently to make it fall. The mere felling of the tree, at California prices for wages, cost the sum of $550.

A short distance from this tree was another of larger dimensions, which, apparently, had been overthrown by accident some forty or fifty years ago. It was hollow for some distance, and when I was there, quite a rivulet was running through its cavity. The trunk was three hundred feet in length; the top broken off, and by some agency (probably fire) was destroyed.

At the distance of three hundred feet from the butt the trunk was forty feet in circumference, or more than twelve feet in diameter. Fragments of the same kind of tree, which had apparently been exposed to the vicissitudes of climate and weather the same length of time, and supposed to be from the individual tree that lies prostrate, are to be found projected in a line with the main body, one hundred and fifty feet from the top; proving to a degree of moral certainty that the tree, when standing alive, must have attained the height of four hundred and fifty or five hundred feet!! At the butt it is one hundred and ten feet in circumference, or about thirty-six feet in diameter. On the bark, quite a soil had accumulated, on which considerable-sized shrubs were growing. Of these I collected specimens of currants and gooseberries on its body, from bushes elevated twenty-two feet from the ground.

The mammoth trees are situated in a dense forest of sugar and yellow pines, balsam fir, white cedar, (*Libocedrus decurrens*, which, in its foliage, much resembles the American arbor vitæ,) and a little yew, supposed to be *Taxus canadensis*. Although it does not greatly exceed some of these in height, yet its stately and majestic bearing strikes the beholder with awe and wonder, and one almost involuntarily bows to it as the king of the forest. The bark is of a dull brown color, varying much in thickness, sometimes being fifteen inches or more. The whole number of these trees in existence, young and old, does not exceed five hundred, and all are comprised within an area of about fifty acres. Only eighty or ninety of them are of a gigantic size. Their extremely limited locality and number forcibly impressed me with the belief that the species is soon to become extinct, as is further evinced by its slow reproduction. Indeed these giants of the forest are so marked in their rusty habit from their present associates, that we can hardly view them in their present relations, except as links connecting us with ages so long past, that they seem but reminiscences of an eternal bygone. They seem to require but the process of petrifaction to establish a complete palæontological era. If Professor Lindley's estimate of its age be correct, one tree only is propagated in six years; or, if Dr. Torrey be correct, one only in two years. A remarkable peculiarity I observed with regard to their fruit cones, namely, they were in every state of development, from the germ to the ripe fruit. I was near them about the middle of May, when the ground was literally covered with their cones and seed.

The leaves are triangular and scale-like, as in the cedars, but never dimorphous or expanded into flat lamina, like many others of the same tribe of Cupressinæ, as Dr. Gray supposed might be the case. The wood is deep red, much resembling that of the celebrated redwood of the Coast mountains, so that the two trees were confounded for a long time. The value of the wood for timber is a matter of speculation merely, as it is too limited in quantity and locality to excite much interest, except, indeed, to wrest it from its apparent doom by cultivating it in plantations. Such an experiment with so noble a tree would surely be worthy an assiduous and laborious trial.

Sequoia sempervirens.—*Redwood.*

This, which was long known as the *Taxodium sempervirens* of Don, is a noble and splendid ree. It is found along the Coast mountains of California, from near the region of Monterey to Russian river, above the bay of Bodega; but, whether those are its extreme limits, I am unable to learn. It does not reach into the interior of the State, and is never found at any considerable distance from the Coast range of mountains. In the neighborhood of San Francisco, amid the deep mountain gorges, I have measured fallen trees eleven feet in diameter, and paced their length two hundred feet; and I have seen others standing which appeared very much taller, but I had not the time, nor the means at hand, to measure them. I have been told, however, by men of credibility, that they grow from one hundred and eighty to three hundred feet high. It has been but lately separated from the genus *Taxodium*. The gifted, but unfortunate Douglas, was among the first to notice the peculiar gigantic forms of these trees of California, and from this fact many English botanists ascribe to him the credit of discovering the still more gigantic Washingtonia. Another reason assigned for this opinion is, that he penetrated as far

north as 38° 45′ north latitude, and saw gigantic trees, whence it is inferred he must have seen them both. But I have been assured by Dr. Randall, who was well acquainted with Douglas' botanizing localities, that he never penetrated inland while in California, much less that he visited the mountains of the Sierra Nevada; and, consequently, he could not have encountered the mammoth Washington tree.

Little has been written of the valuable qualities of the redwood for timber, it having come into general use but for a comparatively short time—that is, since the settlement of California by Americans. The wood resembles the cedar a good deal in lightness and susceptibility of polish, but it is of a slightly darker shade of red. In the rural districts, along the coast, farmers use it for making fencing rails; and it is almost certain to excite incredulity, to state the number of rails that can be made from a single tree. They are counted by thousands, as we count them by hundreds in the eastern States. For building purposes and cabinet work, it probably excels every other tree in California. In the cities and towns, where its transportation can be afforded, it takes the place of every other wood. Oregon lumber is frequently brought into the San Francisco market at a cheaper rate than it can be brought from the surrounding hills, only a few miles distant. The foliage of this tree is dimorphous, as in most of the cypress tribe; the younger and more thrifty branches having a two-ranked dilated lamina, as in the spruce, while the older ones assume the scale-like foliage of the cedar. I collected the old cones of last year's growth, but fear I failed to procure the seeds, all having already been shed.

Libocedrus decurrens.—*White Cedar.*

This tree, in California, is called "white cedar," but it is quite different from the tree of the same name in the eastern States. I presume it is so called from its having somewhat of a resemblance, in foliage and habit, to the American arbor vitæ. The fruit-cone, and the arrangement of the leaves, however, are quite different, and justify the botanist in separating it from the genus *Thuya*, to which it is closely allied. The excellent representation given by Dr. Torrey, in Plantæ Fremontianæ, (*Smithsonian Contributions to Knowledge*,) Plate 3, pp. 7 and 8, is correct, excepting that the fruit-cones are represented as being erect, whereas they are pendulous. This error probably resulted from the drawing having been made from dried specimens, rather than from nature. The tree is only to be found at an elevation of some four or five thousand feet above the level of the sea, in the Sierra Nevada mountains of California. I found it fifteen or twenty miles southeast of Sonora, on the head-waters of the Stanislaus and Tuolumne rivers, (both of which are considerable affluents of the San Joaquin,) south of 38° north latitude; and also on the head-waters of the Calaveras and Mokelumne rivers, in juxtaposition with the Washingtonia. Dr. Torrey remarks, that it ranges as high as 41° on the head-waters of the Sacramento river. In company with the Washingtonia, it appeared nearly as tall as that tree. It certainly attains a height of over two hundred feet. The timber is much sought for by farmers in that region for making rails and fencing-timber, as it is considered superior in durability to the other species of pine in the neighborhood. The wood is very light, of a dirty yellowish hue, and is thought to be more durable than redwood.

Torreya californica.—*Nutmeg tree* of California.[1]

I found this interesting tree not very far from the coast, near Tomales bay, in a deep ravine, called "the Redwoods." I am told that it grows also on the American fork of the Sacramento river. I was anxious to obtain the one from the latter locality, in order to determine whether it might not be a different species from that which grows near the coast, as the plants of the coast and Sierra Nevada mountain seldom intermingle. It has a foliage very similar to the spruce, but the fruit is very characteristic and different in appearance from any of the family in

[1] See a description of this tree by Dr. Torrey, in the New York Journal of Pharmacy, Vol. 2. It has since been described by Sir William Hooker, in the Botanical Magazine, under the name of Torreya Myristica.

America. It very much resembles the nutmeg—so much so, indeed, as at one time to deceive some pretty well informed persons, and make them believe it was not a "*wooden nutmeg*," but a nutmeg in *fact*—in quality as well as in appearance. It is a great pity that dame Nature should amuse herself by playing such pranks, and endanger the monopoly of our good Yankee friends in the manufacture of this aromatic luxury!

This tree grows from forty to fifty feet high, with very slender, drooping branches, and a thin, light foliage. The bark is smooth, somewhat resembling that of the common black mulberry, and the wood hard and firm. Very little is known with regard to its durability or fitness for timber for railroad or domestic purposes. It is closely related to the Podocarpus of tropical regions, and yews, which are common to the temperate regions of Europe and America. According to Professor Lindley, these, and kindred genera, yield "timber which is unsurpassed for durability and elasticity;" from which we may safely infer that the timber of this tree, when it comes to be known and tried, will prove to be truly valuable.

Unfortunately, we were not in California at the season for collecting the nuts, all of these having been long before destroyed by squirrels, rats, and other vermin, which are said to be exceedingly fond of them. According to the statement of Dr. Randall, the nut is too bitter and terebinthinate to be of any use in domestic economy; but no doubt it would make an excellent remedial agent in many diseases.

The true nutmeg is a native of the tropics of India and America, and widely separated from this tree in its botanical relationship.

Taxus canadensis.—*Yew.*

I much regretted being unable to obtain the fruit of this plant. It grows in the forest, with the giant Washingtonia, and also at Downieville, about a degree and a half further north. Mr. Lobb, while there, pronounced it (without seeing the fruit, however) the *Taxus baccatus*, which is the European species. The tree is small, but the wood is very tough and elastic, being much prized by the Indians for making their bows. On examination of its fruit and seeds, it may turn out to be quite a distinct species from its Eastern congener.

Pinus sabiniana.—*Sabine's pine.*

This tree is so called by Dr. Randall and other California botanists, who have paid special attention to this department of botany. From not having proper books at hand for reference, we are unable to determine by whom it was first noticed or described. It is found on the lower western slopes of the Sierra Nevada, about Sonora, Mokelumne Hill, Grass valley, and Nevada city. On ascending the mountains its place is taken by Douglas' spruce, sugar-pine, balsam-fir, white cedar, and the yellow pine, of that region. It bears a very large ovate cone, the scales of which are armed with large upturned, hooked spurs. The nut is said to be large and edible. This tree has not the erect and rigid appearance of most other pines, but is flexuous and crooked, like many deciduous-leaved trees. The foliage is also thin, of a very light green, giving it a very peculiar aspect, different from that of all other species of pine in California. The wood is tough and elastic; but with regard to its durability, when exposed to the weather, no means of determination were had, from the fact that it is seldom or never used in the districts where it grows. This results from the sugar and yellow pines being abundant, and much superior to it for lumber.

Pinus insignis.—*Seal pine.*

This pine, which I have named on the authority of Dr. Randall, is found along the Coast mountains, in the neighborhood of the city of San Francisco. It is found also on the Yuba river, in the vicinity of Nevada city. As it is not a very large tree, and neither used nor

sought for in the neighborhood where it grows, the presumption is that it cannot be very valuable. This, however, is only a negative testimony against it, for it is surrounded and associated with other trees which are much superior to it in size and beauty.

PINUS.—*An undetermined species.*

High up in the mountains east of Sonora, (almost in the snowy regions,) and also at Cajon Pass, a pine was discovered very nearly related to the yellow pine of this country, (*P. brachyptera*,) but the cone is larger and more cylindric; the scales armed with a strong recurved spine; the leaves longer, regularly in threes, and with a longer sheath. A very good figure was made of this pine by our artist, Möllhausen. It is a large tree, with a lighter-colored bark than the *P. brachyptera*, and fully as valuable for its timber. I am not certain that it is a new species.

No. 3.

DESCRIPTION OF THE CACTACEÆ.

BY GEORGE ENGELMANN, M. D., OF ST. LOUIS, AND JOHN M. BIGELOW, M. D.

MAMILLARIA, Haw.

I. Eumamillaria. Englm. in Synops. Cact.

1. Mam. Wrightii, Englm. in Rep. of Bound. Com.: Flowers and fruit were unknown until specimens brought from the Pecos flowered in Washington. From these the following description was drawn:

"Sepalis exterioribus triangularibus obtusiusculis fimbriatis sub–13, interioribus margine petaloideis acutis sub–8, petalis (purpureis) lanceolatis acuminatis aristatis sub–12; bacca succosa majuscula purpurascente floris rudimentis coronata; seminibus obovatis basi acutis scrobiculatis nigris. (Pl. I.) I am not certain whether the flower is actually lateral and the germen immersed, whether, therefore, this species actually belongs to the true *Mamillariæ*, or to the subgenus *Coryphantha;* I am, on the contrary, inclined to consider at least the germen immersed. I, nevertheless, think it best to leave this species with the *Crinitæ*, to which it seems to be so nearly allied, till more complete observations establish the contrary. The flower is about one inch long, petals and margin of inner sepals bright purple; berry large and purplish; seeds about 0.7 lines long."

High plains near the Gallinas. Hills and rocky places near Anton Chico, on the Pecos, September 25, 1853. Santa Rita del Cobre mountains, near Lake Santa Maria, Chihuahua. Wright and Bigelow, in boundary collections.

2. Mam. Grahami, Englm. in Rep. B. C. Sand and gravelly banks of streams. Williams' river to the Colorado Grande, January 26, 1854.

3. Mam. phellosperma, Englm. in Synops. Cact. (M. tetrancistra Englm. in Sillim. Jour., Nov. 1852): Living specimens of this and the preceding species have been brought to Washington, and are now growing in the Congressional garden. Few specimens only show more than one of the 4 central spines hooked. The manifestly improper name previously adopted had therefore to be altered. "I have substituted for it a name derived from the peculiar spongy or corky appendage of the seed, which greatly resembles that of the seed of *Potentilla paradora Nutt.*"—(Engelmann.) Sandy banks of streams, Colorado Grande and Mohave, February 4–23, 1854. The external habit of this plant very much resembles that of *M. Grahami*, and was collected in nearly the same localities.

4. Mam. meiacantha, Englm. in Rep. B. C.: Distinguished from *M. applanata* by the fewer and stouter spines, central spine often wanting. Cedar plains near the Llano Estacado to the Pecos, September 23–27, 1853.

II. Coryphantha. Englm. Synops. Cact.

5. Mam. nuttallii, Englm.: var. *γ. robustior* aculeis lævioribus radialibus sub-12, centrali robusto. The northern and Texas plants have pubescent spines.

Plains on the False Washita and Canadian, near Fort Arbuckle, August 22–29, 1853.

6. Mam. vivipara, Haw.

β. Neo-Mexicana, Englm. in Rep. B. C.: Found in many different forms, from the plains of the Canadian, in longitude 100°, to the Aztec mountains, in longitude 112° west. The forms mostly belong to the var. *β. Neo-Mexicana*. One of the specimens brought to Washington bore abnormal flowers, quite interesting in a morphological point of view. The ovary is 4–5 lines long, covered with 8-12 fimbriate sepals, (or scales,) much like the ovary of an *Echinocactus*, the ovules deformed or wanting; styles irregularly divided to the base, or nearly so, in 8-10 parts, stigmatose at the upper part; other parts of the flower normal. This plant occurs in the greatest variety of altitudes through 12 degrees of longitude. Specimens of it were collected on the top of the Sandia mountains, near Albuquerque, upwards of 13,000 feet above the level of the sea, September 4, 1853, to January 17, 1854.

ECHINOCACTUS, Link.

No specimen of this genus was found till the Colorado Chiquito was reached. From there to the California mountains five species were observed, two only of which, *E. Lecontii* and *E. Emoryi*, had before been seen any where else.

1. E. Whipplei, (sp. nov.): globosa-ovatus, costis 13–15 (sæpe obliquis) interruptis tuberculatis, areolis orbiculatus approximatis; aculeis radialibus compressis albidis, infra brevioribus, supra deficientibus; aculeis centralibus 4 radiales superantibus, summo complanato recto albido ceteris plerumque longiore compresso-quadrangulatis fusco-atris, demum cinereo-rubellis, 2 lateralibus rectis sursum divergentibus, inferiore robustiore deorsum hamato; flore? bacca? seminibus oblique obovatis opacis minutim verrucoso-tuberculatis. (Plate I.)

This species was discovered on Lithodendrow creek, near the Colorado Chiquito, about 90 miles west of Zuñi, in sandy plains, December 3–4, 1853. At first only dead specimens were found, afterwards young living ones were collected. It was not seen after leaving the valley of the Little Colorado. We have named this very pretty species in honor of Captain A. W. Whipple, the zealous and talented commander of this expedition.

Our plant is from 3 to 5 inches high, and 2 to 3 or 4 in diameter. The outer spines are straight or slightly recurved 6–9 lines long, the lower ones shorter than the others. The two lowest lateral spines are darker, and almost form a cross with the two upper dark central spines; the 5 other radial spines are white. The upper central spine is the longest and broadest of all, being 12–18 lines long, and $\frac{1}{2}$ to $1\frac{1}{4}$ line broad at base, and mostly straight, and directed upwards almost contiguous with the radial spines, the circle of which it seems to complete. The 3 other central spines are a little shorter, 12–15 lines long, nearly equal among themselves, quadrangular compressed, often somewhat curved, dark brown or black when young, with lighter tips; afterwards reddish, and finally of an ashy color. The lowest one has a sharp recurved hook, which is whitish on the convex side of the curvature.

Among the debris of the dead specimens preserved, a number of seeds were found which no doubt belong to this species. They are large 1.6—1.7 lines long, and 1.2 lines in diameter, very little compressed at the upper part, narrowed down to an acute point below the large orbicular hilum, and sharply carinate on the lower part of the back (opposite the hilum.)

E. Whipplei evidently belongs to the section *Hamati*, found in numerous forms on the middle and lower Rio Grande; with *E. polyancistrus* it is, so far as at present known, the only representative of this section west of the Rocky mountains. It is more nearly allied to *E.*

brevihamatus Englm. from Eagle Pass, the seeds of which are as yet unknown. It is, however, easily distinguished by the arrangement of the spines; the eastern species has 11 terete radial spines all around, and 4 central ones, the uppermost one being smaller and narrower than the lower hooked one.

2. E. POLYANCISTRUS, (sp. nov.): ovatus s. demum subcylindricus, costis 13–17 obtusis tuberculatis interruptis; areolis orbiculatis s. cum areola florifera contigua minore ovatis, junioribus fulvo-tomentosis; aculeis radialibus sub-19 compressis albis, summo deficiente, superioribus latioribus longioribus apice adustis, lateralibus brevioribus, inferioribus brevissimis subsetaceis; aculeis centralibus 2–3-formibus, summo singulo (rarius binis) compresso-quadrangulato elongato albo apice adusto sursum curvato, reliquis 5–10 teretiusculis s. subangulatis purpureo-fuscis, 2 superioribus plerumque rectis (rarius uncinatis) ceteris omnibus arcete uncinatis; floribus in axillis summis solitariis; sepalis sub-25 orbiculato-ovatis abrupte acuminatis mucronatis ciliatis, petalis acuminatis aristatis, stigmatibus 9–10. (Plate I, fig. 1–2.)

On gravelly hills and sandy plains at the headwaters of the Mojave, on the eastern slope of the California Cordilleras, one day's journey before reaching the Cajon Pass. This elegant and striking species was collected March 15, 1854, with young flower buds. The plant is 4–10 inches high and 3–4 in diameter; areolæ 4 lines in diameter and (from center to center) 7–9 lines distant from one another; the younger ones covered with a reddish-yellow wool. The 4 upper radial spines 1–2, lateral ones $\frac{3}{4}$–1, and lowest $\frac{1}{2}$ inches long. The upper central spine is 3–5 inches long and $\frac{1}{2}$–$\frac{3}{4}$ line wide; sometimes a second similar, but smaller, one is seen above or beside it. All the other central spines are bright purple-brown, the upper ones longer, (2–3 or even $3\frac{1}{2}$ inches long,) the others gradually shorten, the lowest not more than $1\frac{1}{4}$–$1\frac{3}{4}$ inches long; the two uppermost brown spines are often straight, but sometimes, like all the lower ones, sharply hooked, the hooks being turned in different directions; the convexity of the hook is of a paler color. In the young or smallest specimens we find only 5 brown spines, all hooked, one in the centre of the others; in others 5 to 7 or 8 brown hooked spines are counted, one central to the others, or all in a semi-circle, the upper part of the central circle always closed by the broad white spine.

The flower buds were just forming in the axils of the half-grown spines; those glandular organs which divide the floriferous from the spiniferous areolae in *E. Setispinus*, and other species, seem to be very partially only, and incompletely developed in this species.

3. E. LE CONTEI, Engelm. in B. C. Rep.: ingens ovatus s. ovato, cylindricus, costis 20–30 compresis sub-obtusis interruptus, areolis elengato-oblongis approximatis; aculeis radalibus inferioribus superioribusque robustioribus 8–10 angulatis subannulatis plus minusve recurvatis, aculeis extimis lateralibus summisque 10–15 tenuioribus setaceis flexuosis; aculeis centralibus 4 compressis carinatis annulatis 3 superioribus sursum inferiore deorsum curvatis; floribus plurimis subcentralibus, ovario squamis 30–40 reniformibus tecto, sepalis tubi oblongis 20–30, petalis 25–30 angustis sulphureis, stylo ad medium in stigmata sub-14 linearia subacuta diviso; bacca globosa sicca squamosa floris rudimentis coronata, seminibus oblique obovatis compresis sublucidis minutissime scrobiculatis.—(Plate 1, figs. 3-5.)

This gigantic species was first noticed by Dr. John L. Le Conte, on the lower Gila, where also Dr. C. C. Parry saw it. Both took it for the New Mexican *E. Wislizeni*, to which, indeed, it bears a great resemblance in habit as well as in botanical characters, but the seed that I received from the first-named gentleman at once satisfied me that I had a distinct species before me. Subsequently Dr Bigelow met with this remarkable plant, abundantly, from the Cactus Pass, at the head waters of Williams' river, down this stream to the Colorado, and west of it till *E. Polycephalus* took its place.—(Englemann.) It grows on rocky or gravelly plains and ravines, and often in crevices of perpendicular rocks, to the height sometimes of 5 feet by 2 feet diameter. The ribs are somewhat interrupted by a transverse incision between the areolae.

These areolae in the specimen before us are 8 lines long by 4 wide, and only $\frac{1}{4}$ inch distant from one another. In some specimens of *E. Wislizeni* the same closeness is observed, while in others, especially young and vigorously growing ones, they are often over one inch distant. The four principal central spines are 2–2$\frac{1}{2}$ inches long, lateral ones more quadrangular, the upper and lower ones flat and flexible; the former carinate above, the latter below. This lower one is rather the longest and 1$\frac{1}{2}$–1$\frac{3}{4}$ lines broad, almost straight or somewhat curved, but never (in the specimens brought home) hooked. The other spines are 1$\frac{1}{2}$–2 inches, the lowest are only about 1 inch long. Five radial spines are arranged below the four central ones and three to five above, three of which are often pushed into the centre by the flexuous bristly spines which occupy the space between the upper and lower radial ones and the uppermost part of the areola.

At the upper end of the areola, and between it and the floral areola, we meet with the same obtuse cylindric ligneous (when young, fleshy) glands which divide the spiniferous from the floral areolæ in several of our species of *Echinocactus*, 3–5 in number in the species before us, about one line long.

We had the good fortune to collect a single specimen of the fruit, (the only one found,) which is globose, $\frac{3}{4}$ inch in diameter, and, together with the persistent remains of the flower, about 2 inches long. Dr. Le Conte has noticed "a crown of yellow fruits on the plant, about 2 or 2$\frac{1}{2}$ inches long." The dissection of the dead flower indicates a structure very similar to that of *E. Wislizeni;* petals apparently fleshy and narrow; stamina numerous, very few from the base, the majority from the middle and the upper thickened end of the short tube; style 10 lines long, divided nearly down to the middle into 14 sub-erect filiform stigmata; seed black, oblique-obovate, compressed, carinate on lower part of back, somewhat shining, and very lightly pitted, (under the glass,) 0.8–0.9 lines long; hilum small, oval; albumen rather small; embryo ovate, straight, with short hooked cotyledons. Mr. Schott has found this species abundantly in Western Sonora and the Gadsden purchase. The flowers are yellow, and similar to those of *E. Wislizeni*, but rather smaller; the stems are generally much higher and thick, and of a clavate shape; lower central spine sometimes almost hooked.

Echinocactus Wislizeni is distinguished by the less flattened, less flexible, stouter spines, the lower central one being channelled above and strongly hooked; by having only three lower radial spines, &c. The distinction indicated by the spines is confirmed by the shape and structure of the seeds; and thus the plants of the Colorado and of the Rio Grande are distinct representatives of the same type on both sides of the Rocky mountains.

4. E. Wislizeni, Englm. in Wisl. Rep., (Pl. III, fig. 1–2.)—This plant is very abundant in the neighborhood of El Paso, where it was first found, many years ago, by Dr. Wislizenus.

The fruit and seed of this plant were collected by Captain Whipple in the neighborhood of the *Cereus giganteus*, while engaged in surveying the Gila, on the boundary commission, in 1852. There possibly may be some doubt about its growing in that region, however, from the fact that Captain Whipple's fruits were labeled "*Cereus giganteus,*" and were not collected by a botanist.

In our present expedition, when I first found a giant *Echinocactus*—*E. Le Contei*—at Cactus Pass, I was sure, in common with Drs. Parry and Le Conte, that it was *E. Wislizeni*, which I had often seen before at Doña Ana. I was most happy, however, in being able to secure even a single specimen of the fruit and seeds of that plant, by means of which, with the spines I collected, it has been identified and confirmed by the acute observations of my friend, Dr. Engelmann. It may be well to observe here, that the figure of this plant, in Major Emory's report, was made from a specimen seen on the headwaters of the Gila, near the mouth of the Azul branch, not far from Santa Rita del Cobre, or Copper Mines, and at least four degrees of longitude east of the place where first met *Ech. Le Contei.*

5. E. EMORYI, Engelm. in Emory's Report, 1848: globosus, costis 13 tuberculatis, tuberculis prominentibus obtusis distantibus; areolis ovatis; aculeis subæqualibus robustis annulatis subcompressis recurvatis s. rectiusculis fuscis versus apicem corneis, radialibus 7 (lateralibus 6, singulo infcriore breviore) s. addito summo rarius 8; centrali singulo teretiore paulo longiore robustioreque, porrecto s. demum deflexo curvato s. subuncinato. (Plate III, fig. 3.)

Collected west of the Colorado, in the valley of the Mojave, mixed with *E. Polycephalus*, and therefore not further noted. The only specimen preserved is 9 inches in diameter, sub-globose, below contracted, pear-shaped, or almost stiped.

On the lower part of the plant the areolæ are elevated on distinct ovate or sub-cylindric tubercles, which higher up become connected in 8 and on the upper part of the plant in 13 ribs; tubercles on this part of plant $\frac{1}{2}$–$\frac{3}{4}$ inch in height and diameter; areolæ $1\frac{1}{2}$ inch distant, $\frac{1}{2}$ inch long, a little less wide; the floral areolæ smaller, closely connected with the former, separated from it by 1–3 sub-globose glandular bodies, half or mostly hidden in the tomentum. Radial spines $1\frac{1}{2}$–2 inches long; the four upper lateral ones longer and stouter, the two lower ones more slender; the lowest spine the shortest, (1–$1\frac{1}{2}$ inch long,) secured like the others, or rarely hooked, similar to the shape of that spine in *E. Viridescens*.

An eighth upper radial spine, similar to the others, is sometimes observed. The stouter central spine is about 2 inches long, at the point strongly recurved, or often almost hooked. Spines of a reddish-brown color, lighter horn-colored, and somewhat transparent at tip.

This is probably the plant collected and figured by Major William H. Emory, in General Kearny's expedition to California in the fall of 1846, and then named after him. We collected only one young specimen, probably on the Lower Colorado, from which this description is taken. Mr. Schott has found the plant abundantly south of the Gila river, and it is known to extend to the Gulf of California. We procured a large specimen in San Francisco, (said to have been brought from Guaymas,) which is now flourishing in the public garden at Washington. This species has, when full grown, a height of 3 and a diameter of 2 feet, and 18–21 ribs. The large flowers are deep red, similar in form to those of *E. Wislizeni*.

6. E. POLYCEPHALUS (sp. nov.): globosus, demum ovatus cylindricusque multiceps, (e basi ramosus,) vertice dense tomentoso, costis 13–21 acutis; areolis ovate-orbiculatis junioribus tomentosissimis; aculeis 8–12 robustissimis compressis annulatis plus minus recurvatis junioribus puberulis cinereo rubellis apice nudatis rubicundis; aculeis radialibus 4–8 infimo deficiente, superioribus si extant gracilioribus; centralibus 4 robustissimis 4-angulatis compressis, superiore latiore suberecto s. sursum curvato, inferiore longiore decurvo; floribus in vertice congestis; ovario lana nivea ex axillis sepalorum 90–100 linearium demum spinescentium orta densissime vestito, sepalis tubi infundibuliformis 100–120 lineari-lanceolats aculeato-aristatis purpurascenbus, interioribus margine petaloideis, petalis laciniato-fimbriatis herbacea-aristatis sub-30 flavis, stigmatibus 8–11 linearibus acutis; bacca globosa sicca flore coronata, lana densa involuta; seminibus magnis irregulariter angulatis minutim (sub lente) verrucosis, opacis. (Pl. III, fig. 4–6.)

Stoney and gravelly hills and dry beds of torrents from 20 miles west of the Rio Colorado to about 150 miles westward up the Mojave; found in fruit in the beginning of March. This distinguished species is simple only when quite young; even the small globose plants show several heads from one base, and older cylindric stems have as many as 20 or 30 heads, all pretty nearly of the same size; the globose ones are 6–9 inches in diameter; the ovate heads are 12–15 inches high by 8–10 in diameter, and the largest cylindric stems seen were 2–$2\frac{1}{2}$ high by less than a foot in diameter. The number of ribs varies, in old specimens it is generally 21. Areolae about half an inch in diameter, and $\frac{1}{4}$–$\frac{1}{2}$ inch distant from one another; floral areolae smaller, without the ligneous glandular organs noticed in others. The spines in a young 5-ribbed living specimen before us are 7 radial and 1 central one; very soon, however, the 4 upper larger spines become central and 4 lower spines are arranged radially; even in old

and full grown specimens sometimes not more than these 8 spines are found, the 4 upper ones (which are in this case perhaps rather improperly designated as central) stouter and cruciate, and the 4 lower ones arranged around the lower half of the areola. Generally, however, 2 upper radial spines, weaker and less curved than the 4 lower ones, make their appearance; and in a few specimens before us we find 3–4 upper radial spines, the uppermost ones being quite slender.

In the field we noted as many as 15 spines occasionally, when no doubt 7 occupy the place of upper radial ones. The central spines are always very stout but very different in size; in some specimens we find them $1\frac{1}{4}$ to $1\frac{3}{4}$, while in others they are 2 to $3\frac{1}{2}$ inches long; they are nearly straight or very much curved; the upper one is often $1\frac{1}{2}$ to 2 lines wide, the lower one the longest.

The yellow flowers seem to make their appearance in February as the fruit ripens in March; the ovary and the fruit are enveloped in dense pure white cottony wool, which originates from the axis of the lower sepals and through which only the dark reddish-brown spinulose points of the sepals are visible. The incomplete description of the flowers was made from withered specimens adhering to the fruit. Tube of flower funnel-shaped, short and rapidly widening towards the upper end, naked (without free stamina) at the lower part. Petals about 1 inch long and 2 lines wide. Style 1–$1\frac{1}{2}$ inch long, stigmata 4 lines long. Fruit dry 8–10 lines in diameter, together with the remnants of the flower about 2 inches long, open at base when falling off; like the fruit of many if not most of our *Echinocacti*, seeds 2 lines long, $1\frac{1}{2}$ line broad, irregularly shrivelled, appearing rugose and angular, much like those of the nearly allied *E. laticostatus*, (*horizonthalonius Lem.*); hilum transversely oval; embryo curved, the cotyledons buried in the large albumen, accumbent, sometimes oblique.

This species is very nearly allied to *E. Parryi*, Englm. Synops. Cact. of the neighborhood of El Paso, but this latter species is depressed globose, much smaller, simple, with only 13 ribs, whiter, less flattened spines; fruit and seed are said to be the same, but unfortunately have been lost and cannot be compared; no doubt satisfactory diagnostic characters will be dicovered in the seeds; the fruit of *E. horizonthalonius* and *E. Texensis* are also similar, the latter, however, though woolly, is not dry.

Very different in flower and fruit but very similar in shape, in the many heads, numerous ribs, and stout curved annulated spines, is *E. cylindraceus*, discovered by Dr. Parry a few degrees further south on the eastern slope of the Sierra. We shall repeatedly have occasion, especially among the *Opuntiæ*, to indicate the remarkable analogies in the external form or in the more essential character of *Cactaceæ* in different geographical divisions of the southwest.

CEREUS, Haw.

Subgen. ECHINOCEREUS.

1. CEREUS VIRIDIFLORUS, Englm. in Wisl. Rep. Subnom. *Echinocereus.*

On the plains east of New Mexico, near the 100th degree of longitude, to the mountains of the Rio Grande, September 12, 1853.

2. C. CÆSPITOSUS, Englm. in Plant. Lindh. l. c. The most eastern of all our *Cerei!* and only found in the plains. It was first seen about 170 miles west of Fort Smith, near the 96th degree, about the same longitute where Mr. Lindheimer first discovered it on the Brazos, four degrees further south. Its western limit seems to be near the 100th degree, where the range of *C. viridiflorus* commences.

It may not be uninteresting to observe that this is the first time that this interesting genus has been recognized within the boundaries of the United States under the acquisition of Louisiana.

3. C. FENDLERI, Englm. in Pl. Fendl.: Seen first on the high plains 50 miles east of the Pecos, about the 105th degree, and extending from there over the mountains of New Mexico westward to the Aztec mountains, near the 113th degree. Southward it has been seen as far as El Paso.

The ovate or mostly elongated cylindric heads are simple or few together, and of a dark green color; they are characterized by the dark central spine, which is very bulbous and curved upwards, and by the lower radial spines being by far the stoutest, the lowest being 4-angular. Flower and fruit have been described elsewhere.

Var. β. PAUPERCULUS, with only about 6 spines, the central one assuming the place of an upper radial spine, was also found near the Pecos. It hardly deserves the designation of a distinct variety, as occasionally complete bunches of spines occur on the same plants with the depauperate ones.

4. C. MOJAVENSIS (sp. nov.): ovatus, dense cæspitosus, 10–11-costatus, glaucescens; areolis orbiculatis junioribus dense albo-tomentosis distantibus; aculeis basi bulbosis teretiusculis s. subangulatis robustis elongatis curvatis, radialibus 7–8, infimo superioribusque debilioribus, lateralibus longioribus, centrali singulo angulato sursum incurvato. (Plate IV, fig. 8.)

Var. β? ZUNIENSIS: dense cæspitosis 10-costatus, areolis paulo minoribus, aculeis tenuioribus basi bulbosis quadrangulatis rectis s. paulo curvatis flexuosisve, radialibus 8 infimo graciliore, summo robustiore longioreque, centrali singulo robustiore longiore recto s. sursum incurvo. (Pl. IV, fig. 9.)

Found between the Rio Colorado and Mojave creek, with *Echinocactus polycephalus* and *Opuntia erinacea*, etc., a region rich in rare *Cactaceæ*. The oval heads, 2–3 inches high, and $1\frac{1}{2}$–2 inches in diameter, form dense cespitose masses much like *C. phœniceus*. The areolæ are 3 lines in diameter, 6 lines or more distant from one another. The long and very bulbous spines are curved and interlocked so as almost to hide the body of the plant. Upper and lower radial spines 9–15 lines, the uppermost one wanting or weaker than the rest; lateral spines 15-25 lines long, ashy-red when young; central spine more angled $1\frac{1}{2}$–$2\frac{1}{2}$ inches long, dusky; all spines ashy-gray when old.

C. Zuniensis seems to form an intermediate link between this and the next species, but resembles most the former, to which for the present—not knowing flower and fruit—we doubtfully draw it as a variety. It was found near Cañon Diablo, on the Colorado Chiquito, about 120 miles west of Zuñi. Its manner of growth and whole appearance is very much like that of the Mojave species, the spines are weaker, straighter, and more angular; the principal difference consists in the stout upper radial spine, which is similar to the central spine. Young areolæ nearly 3 lines in diameter, 4–6 lines distant; lowest radial spine 6–9 lines, lateral ones 9–15, and upper one 12–18 lines long; central spine $1\frac{1}{2}$–2 inches long, very bulbous at base. Young spines straw colored, old ones ashy.

C. Mojavensis seems to be nearly allied to *C. Fendleri*, (in both the spines are very bulbous at base, the central one single, angular, and curved upwards,) but the cespitose growth, glaucous color, longer radial spines, the lowest one of which is weakest, seem to distinguish it. The examination of numerous specimens *in loco*, and the flower and fruit only can decide here whether they are distinct, or forms of a single species, and this indeed is the case with all those *Cactaceæ* the flower and fruit of which are unknown to us. *C. Zuniensis* was collected December 18, 1852, and the Mojave plant March 4, 1854.

5. C. GONACANTHUS (sp. nov.): ovatus simplex s. e basi parce ramosus costis 7 interruptis, areolis magnis orbiculatis distantibus, aculeis robustis angulatis rectis s. varie curvatis flexuosisve, radialibus 8, inferioribus lateralibusque quadrangulatis flavidis basi et sæpe apice obscuris,

infimo breviore, summo elongato robusto multangulo obscuro erecto aculeum centralem similem multangulatem erecto-patentem subæquante, rarius excedente. (Plate V, fig. 2–3.)

On high sand-bluffs, covered with scattering cedars, near the natural well, about 40 miles west of Zuñi, near the 109th degree. Only seen in that locality. This species resembles, in its growth and the character of its species, *C. triglochidiatus;* it is simple or has 2 or 3 heads, 3–5 inches high; the young areolæ are very tomentose, 3–4 lines in diameter, and 6–10 lines distant from one another; the lower radial spine is 8–12, the others 10–15 lines long, pale or dirty yellow when young; the upper radial spine is much stouter and longer than the others, and resembles the central spine in shape, size, and color; in the few specimens at our disposal, we find it from $1\frac{1}{4}$ to $2\frac{1}{2}$ inches long; sometimes it assumes a more central place in the areolæ, the the two upper lateral spines almost closing above it, very rarely a small tenth spine appears above it. The central spine is $1\frac{1}{2}$–$2\frac{1}{2}$ inches long, 1 line in diameter, deeply furrowed, and 6 or 7 angled; it is longer, equal to or rarely shorter, than the upper radial spine. Both those spines are almost black or mottled yellowish and black when young, and become, with all the others, gray when old. Collected November 29, 1853.

6. C. TRIGLOCHIDIATUS, Englm. in Wisl. Report, Sub-Echinocereo: In rocky cañons at the Rio Gallinas, east of the Pecos, and from there to the Sierra Madre, near Mount Taylor; not noticed farther west; always with few branches, or nearly simple. Major Brooks, the commandant of the fort at Santa Fé, informed me that the fruit of this species is edible, like many other allied species. Collected September 28, 1853.

7. C. HEXAËDRUS, (sp. nov.): ovatus, simplex seu e basi parce ramosus; costis 6 obtusiusculis subinterruptis, sulcis latis superficialibus, areolis orbiculatis distantibus; aculeis tenuioribus rectis rigidis subangulatis basi bulbosis, radialibus 5–7 e flavido rubellis, inferiore breviore, summo sæpe robustiore, centrali robustiore longiore acute-angulato juniore fuscato, sæpe deficiente. (Plate V, fig. 1.)

On sandy hills, under cedars, about fifteen miles west of Zuñi. Few heads 4–6 inches high, 2–$2\frac{1}{2}$ in diameter, with six obtusish ribs, separated by wide and shallow grooves. Areolæ tomentose when young, only $1\frac{1}{2}$ line in diameter, 6 or 8 lines distant. Spines slender, but stiff; quite bulbous at base; lower ones 5–10, upper ones 8–15 lines long; mostly 6 radial spines, without a central one, the uppermost being the stoutest, longest, and darkest one, but smaller where a central spine is present. In a single instance, we found 7 radials, and in another one 2 compressed central spines; central spine usually 12–15 lines long. From the nearly allied, more southern *Cereus paucispinus*, Engl. ined., this northwestern form is principally distinguished by the slender and angular spines. But as of neither of them we know the flower and fruit, we cannot form definite conclusions as to their specific distinction. These forms and *C. triglochidiatus* have a smaller number of ribs than any other species of this section. Collected November 28, 1853.

8. C. PHOENICEUS, Englm. in Synop. Cact., *E. coccineus;* Englm. in Wisl. Rep. non De C. nec. Salm. (Pl. IV, fig. 1.) Found from the Upper Pecos to Albuquerque and Santa Fé, also five degrees further west, on the San Francisco mountains. The specimens perfectly agree with the description given in Wislizenus's report. The numerous heads, 2–3 inches high, about 2 inches in diameter, form dense cespitose masses, often one foot or more across. Areolæ 3–4 lines distant, large; spines slender, almost setaceous, with very slightly bulbous base, 8–12 radial ones, 3–6, 1–3 central ones 5–10 lines long; upper radial spines much shorter than lower ones.

The following form seems very distinct, especially in its manner of growth; but we have seen intermediate forms which seem to indicate the necessity of uniting both. Such questions, however, can only be solved satisfactorily by careful examination of flower and fruit, which are as yet unknown, and by extensive observation of these plants in their native wilds.

9. Sub-species C. conoideus: ovatus versus apicem conoideo-acutatus parce e basi ramosus, costis 9–11 tuberculatis, areolis orbiculatis s. subovatis junioribus albo-tomentosis, aculeis basi bulbosis, radialibus 10–12 tenuibus rigidis rectiusculis, summis brevibus, lateralibus inferioribusque longioribus, centralibus 4, (rare 3–5,) superioribus radiales vix superantibus infimo multo longoire 4–angulato sæpe complanato porrecto s. deflexo. (Plate 4, fig. 4–5.)

On rocky and mountainous localities on the Pecos, *Cer. Roemeri*, Muhlenpf., not Englm., from the San Saba, in Texas, seems to agree well with our plant, but the description is not full enough to decide about their identity.

Heads 3 4 inches high, single or few, of unequal height together; remarkable on account of their conical or acutish shape uniformly observed. Areolæ 4-6 lines distant; spines white or straw colored, larger central one often dusky when young; radial spines slightly bulbous at base; upper ones 2–5 lines, lateral ones 6–15 lines long, and lower ones hardly a little shorter; central spines very bulbous; upper ones not much longer than the lower radial ones; lower central spine sharply quadrangular, mostly compressed, often deflexed and curved, 1–3 inches long.

On the San Francisco mountains, a specimen was collected with 11 ribs, 8–9 radial spines, (4–12 lines long,) the uppermost shortest, and 3–4 reddish-gray central spines, very bulbous at base, the lowest longest (12–20 lines long) and angular. In superficial appearance, this plant resembles *C. Mojavensis*, but it must be referred here, and seems to indicate a range of this form through seven degrees of longitude.

A specimen from Anton Chico, on the Pecos, seems to unite *C. conoideus* with *C. phœniceus*. Areolæ more distant than the latter; spines longer; 3 central spines, lower one somewhat curved and angular. Collected September 28 and December 18, 1853.

10. C. Engelmanni, Parry, var. and variegatus: ovato-cylindricus simplex s. parce e basi ramosus 12-costatus, areolis orbiculatis approximatis, aculeis exterioribus sub-13 gracilibus rigidis albis apice sphacelatis adpressis lateralibus longioribus, summis deficientibus; aculeis centralibus 4 cruciatis (raro 5) plus minus curvatis infimo elongato angulato albo decurvato, ceteris brevioribus teretiusculis nigris corneisque variegatis; floribus ex axillis areolarum vetustiorum inferiorum; bacca ovata sicca pulvillis numerosis setas tenues albidas plurimas gerentibus stipata; seminibus obovato-subglobosis compressis rugoso-tuberculatis opacis. (Plate V, fig. 4–7.)

Var. *β*? chrysocentrus, cylindricus parce e basi ramosus 10–12-costatus, areolis magnis; aculeis radialibus 12–14 albis superioribus setaceis brevibus, inferioribus longioribus robustioribus angulatis compressis rectis s. paulo incurvis, centralibus 4, superioribus rigidis robustis basi bulbosis angulatis rectiusculis elongatis, erectis vitellinis, inferiore angulato compresso albo recto paulo breviore deflexo; floribus ex inferiore plantæ parte; bacca ovata pulvillis paucis aculeos setosos longiores albos gerentibus stipata. (Plate V, fig. 8–10.)

On the Cactus mountains and at the head of Williams river, degrees 113½ longitude. Heads 4–9 inches high, single or few, not more than 4–6 together; areolæ 2–4 lines distant; radial spines 3–5 lines long, upper central spines 3 or sometimes 4, black on the upper, and horn-colored on the lower side and towards the point, 1–1½ inches long, lower central white, 1½–2 inches long. Position of fruit on lower half of plant much like that of *C. chloranthus*, *E. ined*, only 6–8 lines long, crowned with the remains of the (red?) flower. Seed 0.6–0.7 line long compressed, tubercles sometimes irregularly confluent and leaving pits between the ridges, lower part of the back with a smooth carina, hilum oval.

Var. *β* chrysocentrus, named after its deep golden-yellow spines, is, probably, not specifically distinct, though the straighter, stouter, and less divergent spines give it a very peculiar appearance. It was found where *C. variegatus* disappears on the lower part of Williams' river, and was seen from there to the Mojave creek, and up that stream to the Sierra Nevada. Stems 5–10 inches high, areolæ 6–7 lines distant, young ones 2½–3 lines in diameter. Upper radial spines 3–5, lateral 5–7, and lower ones 7–12 lines long; the latter flattened and often curved up.

Upper central spines 3 or sometimes 4, 2–3 inches long, bulbous and angular at base, terete above; lower central spine $1\frac{1}{2}$–$2\frac{1}{2}$ inches long, flattened. Spines on fruit 3–8 lines long, fewer and stouter than in the other form.

Cereus Engelmanni, Parry, has been found abundantly by Mr. A. Schott on the lower Gila; a specimen brought home evidently seems to unite them, and consequently *C. varicgatus* and *C. chrysocentrus* are to be considered forms of it.

I am acquainted with the *habitus* of about 15 or 16 spccies of the subgenus ECHINOCEREUS. All of them are of low growth, (I write of those only with which I am acquainted,) never more than 12, seldom more than 8, and often less than 5 inches in height. All, also, are more or less cespitose, or branching from the root; some of them slightly, others very much so. *Cereus viridiflorus*, *chloranthus*, *dasyacanthus*, *ctenoides*, *cæspitosus*, *longisetus*, *Fendleri*, *gonacanthus*, *hexædrus*, *paucispinus*, and *Engelmanni*, grow in small irregular tufts, or masses, some of the joints or stems being much taller than others. Some of them, such as *C. viridiflorus*, *dasyacanthus*, *ctenoides*, *cæspitosus*, and *Fendleri*, are often nearly simple, or having but few branches; while others, such as *C. chloranthus*, *longisetus*, *gonacanthus*, *hexædrus*, *paucispinus*, and *Engelmanni*, have usually 8–20 joints. *C. polyacanthus*, *phœniceus*, and *enneacanthus* are much branched, and grow in somewhat flattened masses, sometimes with a circular outline, but not always, all the joints being of nearly an equal height. *C. stramineus* always forms a dense hemispherical mass, of a perfectly regular contour—the central joints being the oldest and longest—9–12 inches high, gradually subsiding towards the circumference of the mass until the extreme outer stems are not more than 2 inches high. *C. Mojavensis* often grows similarly, but I have also seen it in much broader masses, containing 500–800 heads or joints; in such cases it is always flattened on the top. Where this state occurs, the central joints are as high as in the hemispherical masses, but the hemispheric contour is destroyed by the longitudinal extension of the joints, forming masses sometimes 4 or 5 feet in diameter. *C. phœniceus* and *C. conoideus*, two forms which Dr. Engelmann has united into sub-species, are quite different in their manner of growth. *C. phœniceus*, as stated above, grows in irregular flattened masses, while *C. conoideus* has the more elevated and somewhat hemispherical shape of *C. stramineus*. On account of the unfavorable season of the year (October—March) during our journey through regions of these cacti, we were unable to procure the flower or fruit of any of these plants. In our friendly correspondence with Dr. Engelmann, I insist that *C. phœniceus* and *C. conoideus* are distinct species, and (from analogy only) I assume that when the flower of *C. conoideus* is obtained, it will be found to be a *purple*, while that of *C. phœniceus* is *crimson*. Time and observation, however, are the only decisive arbiters of such controversies.

Subgen. EUCEREUS.

Of *Cereus* proper only one species was seen, viz:

11. CEREUS GIGANTEUS, Englm.: Williams' river to the Colorado of the west, February 4 to February 22, 1854. This is the most northern true *Cereus* that we have, being found as high as latitude 34°, while *Cer Greggii* and *Emoryi* are found only a little above latitude 32°. This plant has a considerable range, extending south, from this place to near latitude 28° in the vicinity of Guaymas Sonora. The fruit under the Mexican name of *Pitajaya*, pronounced Pit-a-zi-ah or Pit-ai-yah, is a great source of sustenance to the Mexicans and Indians of the regions where it grows. Conserves and molasses, or syrup, are made from them which are preserved during the winter season for future use. They are very pleasant to the taste in a fresh state. As the fruit grows near the top of the tree at an altitude of 25 to 50 feet and being very large and pulpy, if permitted to ripen and drop to the ground, they burst and are almost rendered unfit for use. The Indian mode of collecting them is to take a long light pole, make a fork at the top by tying a short piece to it, by which they contrive to bring them within reach. Birds and every kind of animal and insect that can reach them are so fond of them that man

of them are thus destroyed. My friend, Mr. Schott, of the Mexican boundary, who has lately returned from that desolate but rather interesting region, informs me that still further south this interesting plant is replaced by another not so large—but still a great cactus. This is very probably the one collected by Mr. Thurber, described and named by Dr. Engelmann, in Silliman's Journal, *Cer. Thurberi*. The pitajaya of this species, according to Mr. Schott, is the principal support of the Papige Indians. It is much larger, sweeter, more juicy than that of the *Cer. giganteus*. The color of the pulp is also of a much brighter red.

In consequence of the remote and unhospitable region of this curious and interesting cactus, our acquaintance with it became very gradual. Dr. Englemann thinks that Baron Von Humboldt, in his work on New Spain, must have had reference to this plant, but this is quite uncertain because no characteristics are given of his cacti (organos del Lunal) except size and edible fruit, and many other large species of both cerei and opuntiæ are long and well known to yield them. In 1846, Major Emory first collected seeds and made figures of it which, on being presented to Dr. Engelmann, he was unable to pronounce it a true *Cereus* and at that time very appropriately named it. Subsequently, (winter and spring of 1852,) Dr. Parry, under Major Emory, visited that region, collecting spines, wood, &c., and making copious notes on the ground, enabled Dr. Engelmann to give a good diagnosis of it. Still Dr. Parry was unable to procure the flower or fruit on account of the lateness of the season. It was reserved for Mr. Thurber, who repassed this region in the summer of 1852, to collect complete specimens, and Dr. Engelmann, in a subsequent number of Silliman's Journal, has given a complete description of it. (Vide Amer. Jour., Vol. XVII, 2d series, March, 1854.) To the several excellent accounts given of this tree by Dr. Engelmann, little of interest can be added. As noticed by Drs. Parry and Engelmann, the number of ribs at the base is about 12, and they "increase upward, by bifurcation and addition," to the largest circumference of the tree, which is about 15–18 feet from the ground, and where also usually the few branches are given off. Here the ribs sometimes number 30, and from this point upward they decrease in number to 18–20. The wood at the base of old specimens becomes a perfect hollow cylinder, and from thence upward to the first branches, instead of being solid it becomes a reticulated net-work of bundles of wood continuing the hollow cylinder as is seen on a smaller scale in the wood of *Opuntia arborescens*. These trees in abundance give the landscape a very peculiar appearance, and from their novelty and entire dissimilarity to any others, at first is not only curious but pleasing, but as the eye becomes accustomed to it, a gradual transition takes place in ones feelings and from being pleasing they at last become monotonous and repulsive. This feeling, however, may be somewhat accounted for by the surrounding sterility of the land. As far as the eye can reach in the vallies or on the mountains, little else but rocky boulders and the stately yet awfully sombre aspect of the cereus giganteus can be seen.

OPUNTIA, Tourn.

Subgenus 1. Platopuntia, Englm.

1. Opuntia Engelmanni, Salm. At Delaware, about 170 miles west of Fort Smith, a specimen of this plant was observed about four feet high. This seems to be the northern limit of a species which is widely spread from lower Mexico to the mouth of the Rio Grande, and on both sides of that river, northward and southward. In the southern regions it grows much taller than in the north.

2. Op. Engelmanni, β? cyclodes: erecta articulis orbiculatis, pulvillis remotis tomento griseo setisque stramineis rigidis inæqualibus instructis; aculeis subsingulis rectis validis compressis stramineis basi fuscis defiexis, adjectis sæpe 1–2 inferioribus brevioribus pallidioribus; bacca globosa late umbilicata, seminibus late undulato-marginatis. (Plate VIII, fig. 1.)

About the mouth of the Gallinas into the Pecos, near Anton Chico, New Mexico; collected in fruit in September. Plant 4 feet high; joints orbicular, or even transversely oval, about 7 inches in diameter; pulvilli 1 inch apart, large, with a semi-circle of large, coarse bristles, 3–4 lines long at the upper edge, and a single stout spine, $1\frac{1}{4}$–$1\frac{3}{4}$ inch long, on the upper pulvilli, often with 1 or 2 additional ones, 4–9 lines length. Flower not seen. Fruit globose, 1–$1\frac{1}{4}$ inch in diameter, of a purple color. Seed 2.0–2.3 lines in diameter, with a broad and thick acutish undulate rim. The circular joints with fewer spines, and the small globose fruit with large seeds, distinguish this form from *O. Engelmanni*, as it usually appears further south.

3. Op. occidentalis, (sp. nov.): erecta patulo—ramosissima, caule demum lignose terete corticato, articulis grandibus obovatis rhomboideisve, pulvillis remotis griseo-tomentosis, setis flavis s. flavo-fuscis gracilibus confertis, aculeis 1–3 validis compressis angulatis rectis deflexis divergentibusve, uno alterove ad articuli marginem superiorem erecto, albidis corneisve subannulatis basi flavo-fuscis cum adventitiis 1–2 gracilioribus pallidioribus deflexis; flore flavo intus aurantiaco, ovario obovoto pulvillis fusco-villosis vix fulvo-setosis sub-25 notato subinde parce aculeolato, sepalis (extus rubellis) 10–12 dilatato-obovatis cuspidatis, patalis (8?) obovatis obtusis subintegris; bacca obovata late umbilicata succosa, seminibus majoribus irregularibus undulato-marginatis, crenulatis. (Plate VII, fig. 1–2.)

On the western slope of the California mountains, from QuiqualGungo, east of Los Angeles, to San Pasquale and San Isabel, northeast of San Diego, (A. Schott,) at an elevation of 1,000 to 2,000 feet, in immense patches, often as large as half an acre. Flowers in June. Stout ligneous stems, with innumerable branches, sometimes over one hundred joints, spreading far, and then often bent to the ground; joints 9–12 inches long, 6–8 inches wide; pulvilli $1\frac{1}{2}$–2 inches distant, with slender and closely set (much more so than in *O. Engelmanni*) bristles, only 2–3 lines long on the upper part of the pulvillis; spines 1–$1\frac{1}{4}$, smaller ones $\frac{1}{2}$–$\frac{3}{4}$ inch long. Flower yellowish and orange, deeper colored inside at the base, 3–$3\frac{1}{2}$ inches in diameter; ovary $1\frac{1}{2}$ inch long, not one inch in diameter; pulvilli pretty equally distributed over it, (not as much congregated toward the top as in *O. Engelmanni;*) sepals short and unusually broad; petals only 9 or 10 lines wide by 15 lines in length, rounded, and not emarginate in my specimen, nor mucronate. Fruit 2 inches long, $1\frac{1}{4}$–$1\frac{1}{2}$ inches in diameter, "very juicy, but of a sour and disagreeable taste." Seeds $2\frac{1}{2}$–$2\frac{3}{4}$ lines in diameter. The young plants, raised from the seeds which we brought home, fail to exhibit the very hairy pulvilli which all the young of *O. Engelmanni* show; they bear only the numerous bristly spines seen in most young *Opuntiæ*, at least of this section.

To Mr. A. Schott, who has considerably enriched our knowledge of the vegetation of the countries along the boundary line and in the Gadsden purchase, is due the credit of having discovered the flower of this plant, heretofore unknown, and of many valuable notes about its general habits.

The plant mentioned in Silliman's Journal, November, 1852, (Dr. Parry's collections,) as being common "on the hill-sides and plains near San Diego," and which Mr. Schott seems to have also found "on the sea-beach near San Diego," may be a form of *O. Engelmanni*, as suggested in the above publication; or it may be a naturalized wild state of *O. Tuna*, which is cultivated about the missions there. Enough material has not been obtained to decide about it. At all events, it seems to be distinct from the plant of the western mountain slopes.

4. Op. chlorotica, (sp. nov.): erecta grandis, caule demun-lignoso terete, cortice cinereo-fulvo aculeis flavis numerosissimis fasciculatis armato; articulis orbiculato-obovatis magnis pallide flavo-virescentibus s. subglaucis; pulvillis subremotis griseo-tomentosis, setis stramineis difformibus exterioribus brevioribus tenuioribus subæqualibus confertis, interioribus uniseriatis robustioribus longioribus; aculeis in pulvillis inferioribus 1–3, in superioribus 3–6 inæqualibus stramineis plus minus compressis (nec acute angulatis) plerisque deflexis, interiore breviore

subinde erecto; flore flavo, ovario tubercula pulvilli-gera conferta sub-50 gerente; sepalis tubi sub-20 oblanceolatis cuspidatis, petalis sub-10 obovato spathulatis, obtusis mucronatis, stigmatibus 8 patulis; bacca obovata tuberculosa profunde umbilicata. (Plate VI, figs. 1–3.)

On both sides of the Colorado, from the San Francisco mountains to the headwaters Williams' river, sometimes called "Bill Williams' fork," and to the Mojave creek. The only erect, flat-jointed *Opuntia* in this section of country, 4–5 and sometimes even 7 feet high, forming large bushes, on one of which upwards of one hundred joints were counted. The large trunks have a scaly, grayish, or light-red brown bark; the pulvilli are not obliterated on it, as they are on *O. Engelmanni*, but are largely developed, 4–6 lines in diameter, pulvinate, densely covered with a thick brown tomentum, surrounded by numberless straw-colored bristles, 4 lines in length, and bearing 20–30 or more yellow, compressed spines, often 1–2 inches in length, stellately radiating in every direction, and covering and shielding the whole surface of the stem. The only *Opuntia* which I find described as having a similarly armed stem is *O. Karwinskiana*, Salm., which is said to have 18–20 gray spines on the oldest pulvilli.

Joints 8–10 inches long by 6–8 wide, always of a very pale glaucous, or rather more yellowish green color, which is strikingly characteristic, even at a distance, and which has procured our name for the plant; pulvilli about 1 inch apart, strongly pulvinate; bristles two-fold and distinct, the upper and outer, and by far the most numerous ones are shorter and thinner, and cover the upper semi-lunar area of the areola; inside of them is a semi-circular row of stouter and longer bristles, 4–6 lines long, which unite with the outer and shorter spines of the outer and lower margin of the areola. This arrangement is most distinct on the upper and more fully developed pulvilli; among our *Opuntiæ* it is only seen again, as far as known, in the obscure *O. dulcis* from Presidio del Norte. Spines proper 1–1½ inches long, pale straw color, with faint transverse markings, hardly darker at base; shorter spines 4–9 lines long.

The description of the flower was drawn from an old withered specimen gathered in winter; it seems pale yellow, between 2 and 3 inches in diameter; sepals and petals remarkably narrow, the latter about 1 inch long, and not half as wide. The ovary and fruit (all the specimens found were sterile) are quite tuberculous; pulvilli crowded, bearing brown wool and short, yellow bristles. Specimens of sterile fruit seen 1¼–1½ inches long.

5. Op. procumbens, (sp. nov.): prostrata, articulis orbiculato-obovatis grandibus pallide viridibus, pulvillis remotissimus griseo-tomentosis, setis flavis robustis valde inæqualibus, aculeis validis 2–4 subinde (in articulis vetustioribus?) 7–9 compressis angulatis inæqualibus, stramineis s. pallidioribus versus basin obscurioribus, sæpe rufis fuscisve, deflexis. (Plate VII, figs. 4–5.)

From the San Francisco mountains to the Cactus Pass, at the head of Williams' river, in rocky localities. Joints 9–13 inches long, 7–9 broad, prostrate, always on edge; pulvilli 1½–2 inches apart; bristles 2–4 lines long, comparatively stout; spines 1–2 inches long; no flower or fruit seen. Very similar to *O. Engelmanni;* but prostrate, with even more distinct pulvilli, and stouter and often more numerous spines.

6. Op. angustata, E. & B.: prostrata s. adscendens, articulis elongato-obovatis versus basin sensim angustatis suberectis; pulvillis remotis griseo-tomentosis, setis fulvis gracilibus; aculeis paucis (2–3) validis compressis albidis s. stramineis, versus basin rufis s. fulvis, adjectis sæpe infra 1–2 debilioribus omnibus deflexis; bacca obovata, tuberculata rubella, late profundeque umbilicata pulvillis 24 stipata seminibus magnis subregularibus late marginatis. (Plate VII, figs. 3–4.)

From the foot of the Inscription rock, near Zuñi, to Williams' river, and westward as far as the Cajon Pass of the California mountains. Prostrate in the first and last-mentioned localities, but sub-erect in the bottoms of Williams' river. Joints 6–10 inches long, and at the upper third 3–4 inches wide, gradually narrowed downwards, rounded above; puluilli over 1 inch

apart, oblong, quite strongty pulvinate, 3 lines long, bearing slender brown bristles; spines in the specimens collected east of the Colorado sharply angular, pale straw colored or whitish, brownish only at the very base, 1—1½ inch long; sterile fruit obovate-subglose, 1–1¼ inch long, with large pulvilli crowded toward the upper end of the fruit, covered with grayish-brown wool and bright brown bristles. The specimen from Cajon Pass has brighter colored spines, with the lower half red brown, not so angular; some erect spines, at the upper end of the joint, almost terete. On this specimen a ripe fruit was collected, from which the above description has been taken; it is 1½ inch long, nearly one inch in diameter, with the wide and flat umbilicus immersed about half an inch; pulvilli on tubercular elevations about 14 on the upper part of the fruit, and 10 along the rim; seeds 3 lines or more in diameter, much compressed, with the broad rim almost curled. Some of the seeds have germinated, and the young plants grow vigorously.

This plant cannot be confounded with any others of one species; some southern *Opuntiæ* have similar, or even more elongated joints, but are erect and almost unarmed, such as *O. structa*, *O. tuberculatus*, *O. lanceolata*, *etc.* *O. polyantha* from South America, seems to be similar, but has smaller and more spiny joints, etc.

7. Op. phæacantha, var. major E. in Pl. Fendl. Mem. of American Acad. IV, page 52.

Near Zuñi.—As both Mr. Fendler and ourselves failed to collect the fruits of this form, it remains doubtful whether it has been justly referred here, or whether it is more closely allied to *O. Camanchica*.

Op. Mojavensis, E. & B.: prostrata, articulis grandibus suborbiculatus, pulvillis remotis, setis grandibus fulvis, aculeis 2–6 validis compressis acute angulatis elongatis plus minus curvatis, fuscis versus apicem pallidioribus annulatis, adjectis infra 1–3 minoribus tenuioribus pallidis; bacca pulvillis 20–25 fusco-setosis stipata. (Plate IX, fig. 6–8.)

On Mojave creek; at the time it was considered identical with the following species, and no further notice taken of it; only a few fragments were brought home, together with a sterile fruit. Spines 1–2½ inches long, stout, bright-brown; fruit 1¾ inch long, oblong; pulvilli crowded towards the upper end. It is possibly a distinct species, but the material too incomplete to permit us more than merely to indicate it.

8. Op. Camanchica (sp. nov.): articulis adscendentibus majusculis obovato-orbiculatis pulvillis remotis orbiculato-ovatis tomentum griseum setasque paucas stramineas fulvasve (in pulvillis terminalibus demum elongatis rigidiores) gerentibus plerisque armatis; aculeis 1–3 s. ad marginem pluribus compressis fuscis s. atro-fuscis versus apicem pallidioribus superioribus elongatis suberectis ceteris deflexis gracilioribus flore? Bacca ovata late umbilicata atro-rubente succosa pulvillis remotis obsoletis seminibus majusculis irregularibus angulatis late marginatis (Plate IX, fig. 1–5.)

On the Llano Estacado, at the base of the hills, in rather fertile soil, from the easten slope of that elevated plain to the Tucumcari hills, near the upper course of the Canadian river. A large plant, spreading extensively, with large rounded joints 6–7 inches long by 5½–7 wide; pulvilli about 1¼ inch remote; bristles dirty-yellowish, greenish or brown, inconspicuous, except at the upper edge, where they often become elongated and stouter; only the lowest pulvilli are spineless, the others bear 2–3 and the marginal ones 3–6 spines; larger ones 1½–2 and in some specimens almost 3 inches long. Flower unknown; fruit very characteristic, distinguishing this species from the nearly allied *O. phœacantha*. It is oval, not narrowed or constricted at base; 1½–2 inches long, 1–1¼ inch in diameter, with a large flat umbilicus ¾–1 inch in diameter, considerably resembling the fruit of *O. Engelmanni*; of a deep-red color and a very sweet juicy pulp. Seeds 2¼–3 lines in diameter, very irregular, angular and often twisted, with sides impressed, mostly with a broad and thick acute or obtuse rim deeply notched at the hilum.

9. Op. TORTISPINA (sp. nov.): prostrata articulis majusculis adscendentibus obovato-orbiculatis pulvillis subremotis stramineo s. fulvo-setosis; aculeis 3–5 majoribus compressis angulatis subinde canaliculatis sæpe spiraliter tortis, albis basi apiceque sæpe corneis, adjectis infra aculeolis 2–3 gracilibus albis; flore ———; bacca ovata areolis sub-20 parvulis notata, late umbilicata, seminibus majusculis regularibus crassis. (Plate V, fig 2–3.)

On the Camanche plains, near the Canadian river, east of the plateau of the Llaño Estacado. Similar in growth to the more western *O. Camanchica*. Joints rounded, 6–8 inches long; pulvilli 1–1½ inches apart; bristles short, except on the edges, where they are 2–3 lines long, but rather slender; spines more numerous than in any other of our species, with juicy fruit, often 6–8, lower smaller ones ⅓–1 inch, larger ones 1½–2½ inches long, entirely white or yellowish horn-colored at base and tip; on the upper areolæ one erect spine, the others spreading in different directions, lower ones deflexed. Fruit similar to that of last species, large, oval, not contracted at base, perhaps less juicy and with a somewhat smaller and deeper umbilicus, 1¾–2 inches long, 1–1¼ in diameter. Seeds 2–3 lines across, thick and quite regular, with a very slight indentation at the hilum.

I had observed that sometimes 2 plants are produced from the same seed; this I found to be the case occasionally with *Opuntia occidentalis*, *Engelmanni* and *dulcis*, one of the young plants always much larger and more vigorous than the other. In examining different seeds of this speceis, I succeeded in finding one with two embryos (see figure), one spirally coiled around the other, both together appearing like one large one.

10. Op. RAFINESQUII, Engelm.: diffusa radice fibrosa, articulis mediis s. majusculis obovatis s. suborbiculatis per-viridibus; foliis subulatis elongatis patulis pulvillis sub-remotis albido-s. griseo-villosis setas graciles rufas demum elongatas gerentibus plerisque inermibus; aculeis paucis plerumque solum marginalibus validis teretibus rectis albidis sæpe basi apiceque rufescentibus erectis s. patulis, singulis s. uno alterove graciliore deflexo adjecto; floris alabastro conico acuto, ovario clavato pulvillis 20–25 griseo-villosis rufo-setosis instructo; sepalis tubi sub-13 oblanceolatis acuminatis, interioribus late petaloideo-marginatis cuspidatis; petalis 10–13 late obovatis eroso-denticulatis sub-marginatis sulphureis basi intus miniatis, stigmatibus 7–8 erectis adpressis fluvo-albidis; bacca ovata basi angustata clavata subnuda pulposa purpurascente, umbilicoinfundi buliformi immerso; seminibus subregularibus compressis, margine plerumque lato compresso sub-acuto. Var. *microsperma* subinermis seminibus minoribus regularibus angustius marginatis. (Plate XI, fig. 1–3.)

In sterile, sandy, or rocky (consisting as well of sandstone as of limestone) localities in the Mississippi valley, Illinois, Missouri, Arkansas, and north to Wisconsin, east to Kentucky, and south, probably, to Louisiana and Texas; westward it has not been found west of the western boundary of Missouri and Arkansas. Flowers in May and June; fruit ripens in the same season, but remains on the plant till the following spring. Joints rather large, orbicular 3–4 inches in diameter, or obovate, 4–5 inches long by 3 in width; a small variety with orbicular joinsts only 2 inches in diameter occurs on sandstone rock in southern Missouri. The color of the plant is dark or fresh-green. Leaves 2½–4 lines long, diameter about one-fourth of the length; pulvilli 9–12 lines apart with short whitish or grayish wool, and bright red-brown bristles conspicuous even in the youngest joints. Spines rarely none, generally few in var. *microsperma*, sometimes disappearing entirely in fertile soil in gardens, etc.; mostly only on the upper part or the edge of the joint, single or rarely 2–3, 9–12 lines long, rather stout, white with a darker tip and sometimes also darker base. Flowers 2½–3½ inches in diameter, sulphur-yellow, mostly with a red centre. Fruit 1½–2 inches long, less than half that in diameter, narrowed at base, the seminiferous cavity not extending to the base; umbilicus funnel-shaped, but with shallow bottom, much wrinkled and scarred; naked by the disappearance of the bristles of the pulvilli, and edible, somewhat acid or sweetish. Seeds 2½ lines in diameter,

hardly more than one line in thickness; rim rather narrow, thick, but acutish. Var. *Microsperma* has seeds only 0.8 or 0.9 line in diameter, more compressed, with quite a narrow rim.

This species has, by western botanists, generally been considered identical with the eastern *O. vulgaris*. Riddell mentions it as occurring in Kentucky and Illinois, Torrey & Gray in their Flora do not give any locality in the Mississippi valley; but Rafinesque had already observed it in Kentucky, and, in his usual careless manner, had indicated 3 species: *Cactus humufusus*, (which growing, "from New York to Kentucky and Missouri," probably comprised both *O. vulgaris* and our species,) *O. cæspitosa*, from Kentucky and Tennesse, and *O. Mesacantha*, from Kentucky to Louisiana. As it seems impossible from his incomplete descriptions to make out what he meant by three different names, and as we know only one species in those States of the Mississippi valley, I take the liberty of discarding those names and of substituting the name of the author for the western species. It is not improper to state here that Rafinesque's vague and partly erroneous descriptions have found their way into Seringe's Bulletin, 1831, page 216, into the Linnæa, vol VIII, into Pfeiffer's Enumeratio Cactearum, page 146, and into other works, but with the substitution of Nuttalls for Rafinesque's name as authority; the "rounded joints" have, in these works, been taken for "globose" or "cylindric" joints, and our plant has been classed with the *Opuntiæ glomeratæ* from Chili and Mendoza.

A large form of *O. Rafinesquii* was collected near Fort Smith, on the western border of Arkansas; further west, where no true *O. Rafinesquii* has been found, several forms were met with, which, though they exhibit some distinctive characteristics, are, perhaps, not sufficiently different to constitute distinct species. The flowers of most of them are unknown as well as the leaves, but fruit and seed were carefully preserved, which not only furnish important characters, but also the means to propagate, cultivate, and further to study them. We append them as sub-species.

1. RADICE FIBROSA.

a. O. CYMOCHILA: diffusa articulis orbiculatis pulvillis subremotis griseo-tomentosis stramineo s. fulvo-setosis, plerisque armatis; aculeis 1–3 robustioribus elongatis teretibus s. subcompressis tortisque albidis basi saepe rufescentibus, patulis deflexisve, additis saepe 2–3 gracilioribus radiatim deflexis; flore? stigmatibus 8; bacca obovata umbilico plano s. parum depresso pulvillis 20–24 griseo-tomentosis parce setulosis, demum nudatis; seminibus irregularibns angulosis margine undulato acuto. (Plate XII, fig. 1–3.)

On the Camanche plains east of the Llaño Estacado, near the 100th degree of longitude, and from there to Tucumcari hill, 80 miles east of the Pecos. Joints $2\frac{1}{2}$–3 inches in diameter, orbicular or very slightly obovate; pulvillis 6–8 lines apart; the very light yellowish-brown bristles numerous, and conspicuous only on the older joints; only the lowest pulvilli of a joint unarmed, upper ones with 2–5 spines, 2 or 3 larger ones, often reddish-brown at lower half, 1–2 inches long, lower, smaller, paler oncs 3–9 lines long. Fruit oval, 1–$1\frac{1}{4}$ inches long, about 10 lines in diameter, purplish, pulpy, sweet, and edible, less contracted at base than *O. Rafinesquii;* seed remarkably irregular and twisted, $2\frac{1}{2}$ lines in diameter, with a wavy or twisted very sharp rim, whence the name which indicates the undulated border.

The orbicular joints, the numerous spines, the oval not clavate fruit, and curiously twisted seed, seem to distinguish this form sufficiently from *O. Rafinesquii*, but these characters may not be sufficiently constant or important to constitute specific difference. The characters of *Opuntiæ* are not yet sufficently studied to permit us to form satisfactory conclusions about their diagnostic importance; so we find a form collected on the Sandia mountains, near Albuquerque, which, in habit and appearance, does not differ from the common form of *O. Rafinesquii*, but which has the seeds of *O. cymochila.*

O. CYMOCHILA, *β.* MONTANA: articulis orbiculatis majoribus inermibus s. margine superiore solum aculeatis; pulvillis remotis stramineo-setosis; aculeis singulis binisve validis albidis

infra fuscis; bacca obovata subclavata seminibus irregularibus acute undulateque marginatis. Joints 3–4½ inches in diameter, pulvilli 9–12 lines apart, spines 12–18, smaller ones 4–6 lines long, on some plants entirely wanting. Fruit 1½ inches long, much contracted at base, with a much depressed, almost funnel-shaped, umbilicus. Seeds cannot be distinguished from those of the plant of the plains.

b. O. STENOCHILA: prostrata articulis obovatis, pulvillis remotis stramineo-setosis superioribus solum armatis; aculeis singulis albidis patulis, 1–2 minoribus deflexis sæpe adjectis; bacca obovata clavata pulposa, umbilico lato parum immerso, seminibus regularibus crassis anguste obtuseque marginatis. (Plate XII, fig. 4–6.)

At the cañon of Zuñi. Joints 4 inches long and 3 wide, flaccid or often lying flat on the ground, (in November;) pulvilli 12 lines apart, small, with yellowish or greenish bristles; larger spines 1–1¼ inches long, smaller ones less than half as long; fruit green or pale red, very juicy; 1½ inches long, but sometimes much enlarged, even more juicy, and 2–2½ inches long and 1 inch in diameter above, long clavate towards the base. Seeds quite characteristic, about 2½ lines in diameter, 1½ line thick, regular, with a very narrow and somewhat obtuse rim, whence the name.

In the same neighborhood another plant was found with similar seed, but smaller, more rounded, and somewhat more spinous joints, fruit less clavate, smaller, seeds similar, but a little smaller.

2. RADICE TUBEROSA.

c. O. FUSIFORMIS: diffusa s. adscendens, radicibus fusiformibus elongatis, irregulariter incrassatis; articulis suborbiculatis majusculis, foliis elongatis subulatis patulis pulvillis subremotis griseo villosis, setas elongatas virescente-fuscas gerentibus, plerisque s. solum superioribus armatis; aculeis 2–3 gracilibus inæqualibus deflexis s. patulis, albidis; floris minoris flavi (basi rubelli?) ovario pulvillis 25 stipato, stigmatibus 8, bacca ovata basi vix clavata demum nudata, pulposa rubella, umbilico immerso subinfundibuliformi; seminibus subregularibus crassis majusculis acute marginatis. (Plate XII, fig. 7–8.)

Cross-timbers longitude 97°–99°; west of the region inhabited by *O. Rafinesquii*, and east of that of *O. cymochila;* also collected by Dr. Wislizenus in the same longitude, but farther north on Cow creek and the Little Arkansas, (on the road from Independence to Santa Fé,) and by Dr. Hayden, of the United States army, on the Missouri, below the Big Bend. Fl. in May. Roots form elongated tubers, attenuated at one or both ends ½–1 inch in diameter; joints 4 or even 5 inches in length; leaves 2½–3½ lines long, pulvilli 9–12 lines apart, with numerous stout yellowish-brown bristles, often 2 lines long, spines 1 or 2, 1–1¼ inches long, with a smaller one of half the length, more slender than in most other allied forms. Flowers 2–2½ inches in diameter, yellow apparently with red base, smaller and with fewer sepals than *O. Rafinesquii*, but the same mumber of stigmata. Fruit 1½ inches long, umbilicus ½ inch wide; seed rather larger and thicker than in *O. Rafinesquii*, 2¾ lines in diameter and 1½ thick. The description of the flower is from the specimens collected by Dr. Wislizenus.

O. MACRORHIZA, Engl., of Texas, also belongs here as another tuberous rooted form in the wide circle of *O. Rafinesquii*.

11. O. BASILARIS (sp. nov.): humilis, articulis obovatis s. subtriangularibus glaucescentibus pubescentibus adscendentibus e basi proliferis, fere rosulatis; foliis subulatis minutis erectis rubellis tomentum axillare vix superantibus; pulvillis subconfertis fulvo-tomentosis setas gracillimas demum numerosissimas breves fulvidas et subinde aculeolos setiformes caducos gerentibus; floris purpureis ovario obovato pubescente pulvillis plurimis (40–60) confertis fulvo-tomentosis instructo, sepalis 20-25 exterioribus oblanceolatis acuminatis, interioribus latc obovatis cuspidatis, petalis sub-10 obovato-orbiculatis retusis s. obcordatis sæpe tenuiter mucronatis,

stigmatibus 8 brevibus in capitulum conicum congestis; bacca (sicca?) breviter obovata late umbilicata, seminibus magnis crassis subregularibus. (Plate XIII, fig. 1–5.)

On hills and in ravines from the Cactus Pass down the valley of Williams river to the Colorado, and to Mojave creek; Mr. Schott met with it on the lower Gila; and both he and Mr. Albert H. Campbell obtained the beautiful purple flowers of this plant in April and May, 1855. The habit of this plant is very different from any other of our *Opuntiæ*, as the stout obovate or often fan-shaped or sometimes almost obcordate joints originate from a common base form a kind of rosette, resembiing somewhat an open cabbage head. Among thousands of specimens observed, none deviated from this peculiar manner of growth, none was proliferous in the shape of the other elliptic *Opuntiæ*. Joints 5–8 inches long, $\frac{1}{2}$ inch in thickness, minutely pubescent; leaves only 1 line in length, slenderly subulate, smaller than any other of our species; next in size are the leaves of *O. Missouriensis*, *O. fragilis*, and *O. filipendula;* the largest leaves are produced by the cylindric *Opuntiæ*, some of which have them 10 lines long.

Pulvilli somewhat immersed, 4–6 lines apart. Flower of a beautiful and rich purple color, about $2\frac{1}{2}$ inches in diameter, ovary nearly 1 inch long, crowded with 40–60 elevated areolæ, with light brown wool and brighter brown bristles; filaments not very numerous, leaving the inner base of the tube naked; stigmata about 2 lines long, or less, apparently green. Fruit seems to be perfectly dry, short and thick; seeds 3 lines in diameter, nearly 2 lines thick, with a rather narrow but very thick rim, regular or sometimes quite irregular.

12. O. HYSTRICINA, (sp. nov.): diffusa, articulis obovato-orbiculatis, compressis, pulvillis subconfertis magnis griseo-tomentosis setas pallidas rutilasve gerentibus, omnibus armatis aculeis 5–7 inferioribus gracilioribus brevioribus albidis deorsum radiantibus, superioribus 5–8 elongatis validioribus angulatis sæpe tortis flexuosisve 3–4 deflexis albidis, uno alterove longissimo, ceteris 2–4 superioribus patulis suberectisve sæpe basi s. ad medium fuscatis; flore ——, bacca obovata subclavata, umbilico parum immerso planiusculo, pulvillis 25–30, inferioribus inermibus, superioribus confertis aculeolos paucos gerentibus; seminibus maximus irregularibus late crasseque marginatis. (Plate XV, fig. 5–7.)

This beautiful species was found abundant from the Rio Grande westward to the San Francisco mountains, mixed with *O. Missouriensis*, to which it is nearly allied. The specimens before us were obtained at the Colorado Chiquito and on the San Francisco mountains. Joints 3–4 inches long and nearly as broad. Pulvilli 5-6 lines apart, unusually large; lower radiating spines 4–9 lines, the others $1\frac{1}{2}$–3 and even 4 inches long, irregularly arranged as we generally find it in this species. We notice many specimens where 3 or 4 larger spines are placed above the lower short radiating ones, the uppermost one of them is usually the longest; somewhat above these are 2–4 other spines, the lower one of which is the darkest and often not much shorter than the one just mentioned, the others are shorter and whitish or dark only at the base. The bristles are yellowish in some and brown in other specimens; sometimes we find short pale and longer darker bristles together. The fruit is 1 inch long and half as thick, with a very shallow umbilicus; only the upper larger pulvilli bear 4–6 spines (2–5 lines long,) the lower ones on the contracted part of the fruit are very small, distant, and unarmed. Seed among the largest in this genus $3\frac{1}{2}$ lines in diameter, the thick and broad rim acutish. The name indicates the porcupine-like armature of this species.

13. *O. Missouriensis*, D. C.: prostrata radice fibrosa, articulis obovatis suborbiculatisve tuberculatis compressis laete viridibus adscendentibus, foliis subulatis minutis patulis, pulvillis subconfertis albo s. griseo-tomentosis stramineo—setosis omnibus armatis; aculeis in pulvillis inferioribus gracilioribus paucioribus, in superioribus 5–10 exterioribus minoribus radiantibus albidis, 1–5 interioribus robustis teretiusculis longioribus patulis, rarius suberectis, albidis s. rufescentibus; floribus sulphureis basi intus sæpe aurantiacis, ovario obovato subgloboso, pulvillis 25–35 albo tomentosis aculeolatis instructo; sepalis tubi sub-13 exterioribus oblanceolatis,

interioribus obovatis cuspidatis petaloide-marginatis, petalis sub-13 obovato-orbiculatis emarginatis s. obcordatis crenulatis sæpe mucronulatis; stigmatibus sub-8 viridibus in capitulum globosum s. conicum confertis; bacca ovata s. subglobosa, umbilico parum depresso, pulvillis 25–35 albo tomentosis setos albidas stramineas s. rufescentes aculeolos que numerosos breves s. elongatos gerentibus; seminibus magnis plerumque irregularibus late subacuteque marginatis. (Plates XIV and XV, flig. 1–10 and 1–4.)

This variable species extends from the country north of the Upper Missouri river to the regions south of the Canadian and of Santa Fé, latitude 48° 35′; and from longitude 99° east of Fort Pierre, on the Missouri, to 112° on the San Francisco mountains. It has not been found south of Albuquerque, along the Rio Grande, nor in the Salt Lake valley, Utah, as far as at present known. Flowering in May, fr. same fall. Nuttall discovered this common western species on the Upper Missouri in 1811, and described it under the name of *Cactus ferox;* he noticed "8–10 greenish stigmata" and the "dry spring fruit." The deep purple fruit, as large as a hen's egg," attributed to our species on the authority of Dr. James, by Torrey and Gray, in their Flora, perhaps belongs to our *O. Camanchica*; it certainly cannot belong to *O. Missouriensis.*

It forms large spreading masses, much dreaded by travellers and their animals. Joints mostly suborbicular, 2–4 inches long, and 2–3½ wide, light green, somewhat tuberculated from hemispherical elevations which bear the leaves and pulvilli, 4–6 lines apart; leaves 1½–2 lines long, hardly more than ½ line in diameter at the base, nearly twice as long as the wool in their axills; numerous small white spines radiating downwards and laterally, sometimes a few rather longer ones obliquely upwards, mostly 3–6 lines long, rarely more elongaged; central spines in the Missouri specimens mostly 1, rarely 2; in the southern ones, often 2–4, 1–1½, or even 2 inches long, terete or somewhat angular, white, or mostly with a reddish base when young, entirely brown red, with lighter tips. On the lower pulvilli the stouter spines are mostly wanting; in some Missouri specimens, I find few and weak spines on the upper, and none at all on the lower part of the joints; in other plants, from the same region, all the pulvilli are nearly equally armed with 5 weaker (2–3 lines long) lower deflexed, and 5 inner stouter (4–6 lines long) spreading spines. Flowers 2–3 inches in diameter, ovary, with subulate sepals, similar to the leaves, spines already present, but not as long and stiff as in the fruit. Petals yellow towards the base, or sometimes almost entirely rose-colored, orange, or brick-colored, sometimes only the margin remaining yellow. Exterior filaments much the longest, deep red; interior ones paler, shorter; pistil pale yellowish, thickened below the middle, as in almost all the species of this genus; stigmata united into a small subconic head.

Fruit ovate, or sometimes globose, umbilicus shallow, spines on the pulvilli numerous, 6–12, usually short, 1–4, sometimes 6 lines long. Seeds about 3 lines in diameter, sometimes larger, in one form much smaller, mostly irregular, twisted, angular, much compressed, with a broad and thick but rather acutish rim. Embryo of different shapes, conform to the shape of a seed, always with a small albumen.

The following forms, we think, must be included under this species, though the whole history of most of them is not known; some of them may not even be constant varieties.

α. RUFISPINA: articulis orbiculatis s. transversis setis parcis rufescentibus, aculeis radialibus 6–8 albidis rufo-variegatis, interioribus validis fuscis apice pallidioribus, 2–4 deflexis, singulo patulo s. suberecto robustissimo; bacca ovata.—(Plate XIV, fig. 1–3.)

This is the shortest form of our species, and greatly deserves Nuttall's original name ferox; It was collected on rocky places on the Pecos; Dr. Hayden has also sent it from the Yellowstone, and it no doubt is met with in all the intervening territory. Joints 2–3 inches in diameter, pulvilli 4–5 lines apart; bristles fewer, but longer and darker than in other forms; central spines 1¼–2 inches long; fruit 1 inch long, half as thick, with shallow umbilicus, about 30 pulvilli, spines on the upper ones 4–6 lines long. Seeds 2½–3 lines in diameter.

β. PLATYCARPA: articulis obovato-orbiculatis, setis parcis stramineis, aculeis exterioribus

5–10, inferioribus albidis, superioribus robustioribus rufescentibus centrali subsingulo robusto fusco patulo s. deflexo; bacca depresso-globosa, umbilico lato plano, pulvillis sub-25 aculeolos 5–10 breves gerentibus.—(Plate XIV, fig. 4.)

Sent from the Yellowstone by Dr. Hayden. A stout form; joints 3 inches long, $2\frac{1}{2}$–$2\frac{3}{4}$ wide; pulvilli 4–6 lines apart, the dirty yellowish bristles visible only on the older joints. Central spine single, or only on vigorous specimens on the upper pulvilli 2, mostly brownish, deeper colored on the margin. Fruit 8–9 lines long, umbilicus, of the same diameter, spines only 1–3 lines long, deflexed. Seed 3 lines in diameter, rim rather narrower than in the first-mentioned form.

γ MICROSPERMA: articulis ut in præcedente; stigmatibus 5; bacca ovata, umbilico parum depresso, pulvillis, 20–30 setosis et breviter aculeolatis, seminibus anguste acuteque marginatis. (Plate XIV, figs. 5–7.)

On the Missouri, about Fort Pierre; brought down 10 years ago by the fur traders. Very similar to the last form in the general appearance; also with only 1, or at most 2, central dark spines; flowers only with 5 stigmata, otherwise same as the one described above; fruit short, oval, with 10–20 very short spines on the numerous pulvilli; seed only 2 lines in diameter, more regular, thicker in proportion, with a narrow and acute rim. It might be supposed that these characters were important and constant enough for a specific difference, if we did not know the great variability in this genus, and if we did not find among Dr. Hayden's plants seeds of intermediate shape and size.

δ SUBINERMIS: articulis elongato-obovatis, pulvillis subremotis, inferioribus, inermibus, superioribus aculeos paucos breves gerentibus.

Brought from the Upper Missouri by Dr. Hayden; remains constant in three years cultivation. Joints $3\frac{1}{2}$–5 inches long, half as wide, gradually narrowed down at base; leaves entirely similar to those of the common form; pulvilli 6–9 lines apart; spines entirely wanting, or on the upper pulvilli 2 or 3 short and slender ones, rarely one or the others more robust, $\frac{1}{4}$–$\frac{1}{2}$ inch long; flowers not seen.

ε ALBISPINA: articulis late obovatis, setis stramineis, aculeis omnibus albis gracilioribus exterioribus 6–10 setaceis, interioribus in pulvillis superioribus 1–3 robustioribus elongatis deflexis s. patulis; bacca ovata, seminibus magnis. (Plate XIV, figs. 8–10.)

Sandy bottoms and dry beds of streamlets on the Upper Canadian, 250 miles east of the Pecos; on the Sandia mountains, near Albuquerque; also, on the Upper Missouri. This was the first form of this species met with in travelling up the Canadian; the stouter and more compact forms were found further west, in higher elevations. Joints 3–4 inches long, $2\frac{1}{2}$–3 wide; pulvilli 4–6 lines apart; spines all ivory white, rarely with a yellowish tinge, larger ones 1–$\frac{1}{4}$ inch long; fruit with very shallow umbilicus, and very slender and short spines; seed 3–$3\frac{1}{2}$ lines in diameter, irregular, rim broad acutish. A form from the Sandia mountains with pulvilli more remote; spines longer, more slender, some of them flexuous; seems to unite this with the next variety.

ζ TRICHOPHORA: articulis ovatis, pulvillis confertis parce albo-tomentosis setas stramineis demun albidas breves gerentibus, omnibus armatis; aculeis 10–18 setiformibus albis, exterioribus 8-12 brevioribus radiantibus, interioribus longioribus deflexis, rarius singulo suberecto; pulvillis in articulis vetustioribus lignosis confertissimis setas numerosas aculeosque 15–25 capillaceos elongatos flexuosos gerentibus; bacca ovata, umbilico parum immerso pulvillis 35–40 albo-tomentosis stramineo-setosis fasciculum aculeolorum 12–18 plerumque deflexorum gerentibus; seminibus maximis valde compressis irregularibus latissime acuteque marginatis. (Plate XV, figs. 1–4.)

Only on the volcanic rocks about Santa Fé, and on the Sandia mountains. The hoary appearance of the older joints is very characteristic, and reminds one strongly of *Pilocereus senilis*. These hairs are from a few lines to 2 or $2\frac{1}{2}$ inches in length, and of the appearance and about as

fine as an old man's beard. The older joints become thick and of a solid ligneous substance; younger joints 4½ inches long, 2½ inches wide, or larger; pulvilli 4–5 lines apart; exterior spines 3–6 lines, interior ones 9–18 lines long. Fruit ovate, 10 lines long, 7 in diameter; very slender and numerous spines, 3–6 lines long. Seeds, with those of *O. hystricina*, the largest known to us, 3½ lines in diameter, sometimes larger; rim large, almost of the tickness of the seed itself. This is, perhaps, a distinct species, and must be further studied.

14. O. SPHÆROCARPA, (sp. nov.): diffusa articulis orbiculatis transversisve tuberculatis; pulvillis confertis albo-tomentosis, setas stramineas breves gerentibus, plerisque inermibus, summis solum et marginalibus aculeos 1–2 reflexos s. patulos, adjectis subinde 1–3 brevioribus gerentibus; bacca globosa, umbilico minore plano, pulvillis sub-25 tomentosis setosis vix aculeolatis, seminibus mediis acute marginatis. (Plate XIII, figs. 6–7.)

On tho eastern declivity of the Sandia mountains, near Albuquerque. Joints in the specimen before us 3 inches wide, less in length, strongly tuberculated; pulvilli 4–5 lines apart; spines on the upper lateral pulvilli mostly single, deflexed, ½ inch long; on the middle or lower ones none; on the uppermost and marginal ones mostly 2, rarely 3 lines long, reddish brown, with darker tip; 1–3 smaller additional spines, 2–4 lines long also reddish. Fruit perfectly globose, 9 lines in diameter; umbilicus 5–6 lines wide; pulvilli bristly, but only the upper ones with one or a few small spines. Seeds 2½ lines in diameter, very irregular, with a rather narrow, but sharp rim.

The arrangement of the spines is so different from any form of *O. Missouriensis*, which always shows the numerous slender radiating spines, and always has spiney fruits, that we feel obliged to separate this plant as a distinct species. The seeds brought home by the expedition have germinated, and are growing vigorously.

15. O. ERINACEA, (sp. nov.): diffusa adscendens; articulis tumidis ovatis s. teretiusculis, pulvillis confertissimis ovato-orbiculatis albo-tomentosis demum stramineo-setosis omnibus armatis; aculeis 3–5 gracilibus elongatis e cinereo-rubellis 1–3 superioribus brevioribus sursum porrectis, centrali longior patulo vel declinato, ceteris deflexis, additis 2–4 minoribus inferioribus; bacca ovata umbilico infundibuliformi pulvillis 30–40 setal stramineas et aculeolos 12–20 gerentibus; seminibus magnis subregularibus late acuteque marginatis. (Plate XIII, fig. 8–11.)

West of the great Colorado near the Mojave creek; joints 2–2½ inches long, 1–1½ inches wide, and about ½–¾ inch thick, sometimes elongated, almost cylindric, densely covered with the large white pulvilli, which are only 2–3 lines apart, and numerous reddish-gray spines with red points bristling hedgehog-like (whence the specific name) in every direction. Spines 6–14 or in old joints even 20 lines long, with smaller ones very slender, flexible, but stiff. Young plants cylindric, covered with bunches of 15 or 20, or more, white hair-like spines. Bristles dirty-yellow even in young joints present, in old ones densely crowded, and 2–3 lines long; in a dead flower a 6-parted stigma was noticed. Fruit 1–1¼ inches long, about ½ an inch in diameter, with a deep funnel-shaped umbilicus; pulvilli crowded, prominent, white-tomentose with yellowish bristles and numerous, mostly deflexed, spines, 3–6 lines long. Seed nearly 3 lines in diameter, much compressed, more regular than in the three foregoing species.

15. O. BRACHYARTHRA, (sp. nov.): prostrata s. adscendens, articulis ovatis s. orbiculatis tumidis saepe subglobosis, tuberculatis; pulvillis confertis magnis albo-tomentosis parce setulosis plerisque armatis; aculeis 3–5 albidis s. fuscatis patulis; 1–2 validioribus sursum versis, caeteris minoribus minimisque subdeflexis; floris parvi; ovario subgloboso, pulvillos 12–15 tomentosos setosos superiores aculeolatos gerante, sepalis tubi exterioribus obovatis cuspidatis stigmatibus 5. (Plate XII, fig. 9.)

At the foot of the inscription rock near Zuñi under pine trees, only seen in that single locality. A singular looking plant with short tumid joints (10–15 lines long, 10–12 wide and

nearly the same in thickness) one growing on the top of the other so as to resemble, somewhat, a jointed finger. In the absence of ripe fruit we are unable, with certainty, to class this species; the shape of the joints and the somewhat spinulose fruit seem to bring it very near to *O. fragilis*, and it may possibly be a small and compact form of this species, though the appearance is very different; on the other hand the subglobose joints seem to refer it to the section *Glomeratæ*, Salm.

Pulvilli 2–4 lines apart, large, white or when old grayish tomentose with very few short yellowish bristles, even in the old joints; spines 9–12 lines long, rather stout, terete, often with 1 or 2 short ones not more than 1–2 lines long. No ripe fruit was found (Novr.) which is also often the case with *O. fragilis*, but many remains of flowers with globose-ovate fleshy sterile red ovaries, 3–4 lines long, some of them becoming larger and probably proliferous, generally only some of the upper pulvilli bear a few short spines. The flower seems to have been about 1 inch in diameter, with about 5 sepals, 8 or 9 petals, and style with 5 stigmata.

O. FRAGILIS, Haw., the seed of which we give a figure of, (pl. XXIV, fig. 5,) grows on the upper Missouri and Yellowstone and probably down to Santa Fé. The joints are small, ovate, compressed or turned, or even terete, 4 larger spines on the upper fully developed pulvilli cruciate, the upper one suberect, stouter and longer than the others, mostly yellowish-brown; on the lower margin 4–6 small white radiating spines; bristles few. Fruit apparently somewhat fleshy, getting dry much later with 20–28 pulvilli, almost naked, only the upper ones with a few short spines; seeds few, large, regular.

Subgen. 2. CYLINDROPUNTIA, Engelm.

§ 1. *Clavatæ.*

17. O. CLAVATA, E. in Wisl. Rep. (Plate XXII, fig. 1–3.) Found from Santa Fé to Albuquerque, where Wislizenus and Fendler had already collected it, and no where else. A remarkable and well characterized species, the type of this section. We add to the characters previously published, (Wislizenus' Report note 12, and Plantæ Fendlerianæ in Mem. Amt Acad. vol. IV, page 49,) that the leaves are long and subulate, 2–2½ lines long; the broades. spines were 1½ lines wide; fruit 1½–1¾ inch long, lemon-yellow, almost covered with 30–50 hemispherical pulvilli, which bear innumerable white slender bristles, spreading ray-like in every direction. Seeds large for this section, and, as in all the allied species, transverse or broader than high; 2¼–3 lines in the longest diameters, rostrate, somewhat angular; commissure (which in the cylindric and clavate opuntiæ replaces the rim of the flat-jointed ones), impressed, linear or a little wider; cotyledons in several seeds examined by me oblique.

18. O. PARRYI, E. in Sillim. Journ., Nov., 1852: Articulis ovatis basi clavatis, tuberculis oblongo-elongatis, pulvillis albo-tomentosis setas paucas rigidas gerentibus; aculeis angulatis scabris rubello-cinereis, interioribus validioribus sub-4 triangulato-compressis, exterioribus 5–8 angulatis supra infraque divergentibus, extimis 6–10 gracilibus rigidis radiantibus; bacca ovato basi clavata pulvillis sub-40 setosissimis stipata; seminibus regularibus latius commissuratis. (Plate XXII, fig. 4–7.)

On the gravelly plains 30 miles west of the Colorado, near the Mojave river; southward to the eastern slope of the California mountains near San Felipe, Dr. Parry. Joints 2½–3 or 4 inches long, 1¼ inch in diameter, attenuated not only below but also somewhat above in the specimen before us. Tubercles about 9 lines long, pulvilli small, bristles few, coarse and long. Spines very numerous in 3 series; the 4 inner ones 12–16 lines long, ½–¾ lines broad, the lower one somewhat flattened, the others triangular; the next series consists usually of 2–3 upper ones and 3–5 lower ones, angular, more slender and shorter than the first, 4–8 lines long; the third or external circle consists of 6–10 bristly slender spines, 3–4 lines long, some above, but

most of them lateral or inferior. Young spines reddish-grey with paler margins, older ones ashy. Fruit 1½ inch long; seed rather regular, 2–2½ lines in the transverse diameter, less than 2 lines high, not beaked, commissure broader and more distinct than in any other of this section examined by us. Cotyledons in all the seeds examined oblique.

This discription refers to the plant brought by the expedition from the Mojave river. Several years before Dr. Parry had described a plant discovered by him "on the hills and plains about San Felipe on the eastern slope of the California mountains," which had been named after the discoverer. We presume that both plants were identical, but have to remark that Dr. Parry's plant is much larger, having joints of 4–8 inches in length, with tubercles 6–12 lines long, spines whitish, half an inch long; he describes the flowers as 1½ inch in diameter, greenish-yellow with green stigmata. Fruit not mentioned. Further investigation will be necessary to clear up those doubts.

From *O. clavata* (which grows 8 or 9 degrees east and on much greater elevation) the Mojave species is distinguished by the shape of the joints, the color, much narrower, more numerous spines and the smaller more regular seeds, with the broad commissure.

§ 2. *Cylindricæ.*

19. Opuntia Davisii, (sp. nov.): caule dense lignoso ramosissimo divaricato adscendente, articulis junioribus erectis elongatis, basi attenuatis; tuberculis oblongo-linearibus prominulis, setis stramineis tenerrimis; aculeis interioribus 4–7 subtriangularibus rufis apice pallidioribus, vagina straminea laxa fulgida indusiatis divergentibus s. deflexis, aculeis gracilioribus inferioribus 5–6; bacca ovata pulvillis sub-25 setas stramineas aculeolosque paucos gerentibus; umbilico lato. (Plate XVI, fig 1–4.)

Common on the upper Canadian, eastward and westward of Tucumcari hills, near the Llano Estacado. A very much branched shrubby, somewhat procumbent, plant, with erect joints, about 18 inches high; wood dense and hard; joints 4–6 inches in length, and half an inch or more in thickness; tubercles not very prominent, 7–8 lines long; very slender bristles, forming a thick brush at upper end of pulvillus; interior spines 1–1¼ inches long, covered with a very loose glistening membranaceous sheath, which makes the plant an object of remark for a long distance; lower spines 3–6 lines long. All the fruits seen on the route were sterile, and most of them elongated, 1–1¼ inch long; on many pulvilli 1–4 sheathed spines were observed, which possibly are peculiar only to the sterile and proliferous fruits.

We have named this well-marked and pretty species after our enlightened Secretary of War, Colonel Jefferson Davis, under whose auspices the expeditions for the exploration of a proper route for the Pacific railroad were organized, and were enabled to accomplish so much, not only for this specific object, but also for the elucidation of the natural history of this hitherto almost unknown country.

20. O. echinocarpa, (sp. nov.): caule reticulato-lignoso, erectiusculo, ramis numerosis patentissimis subinde pene decumbentibus, articulis ovatis basi clavatis, tuberculis ovatis prominentibus confertis, setis paucis stramineis; aculeis albidis stramineo s. albido-vaginatis, majoribus sub-4 cruciatis, ceteri, minoribus 8–16 undique radiantibus; floris flavi (?) ovario pulvillis 30–40 villosis subaculeolatisque confertis stipato, sepalis sub-13, exterioribus ovatis acutis; interioribus obovatis mucronatis, petalis sub-8 obovatis obtusis s. subemarginatis denticulatis, stigmatibus 6; bacca globoso-depressa s. hemispherica, late profundeque umbilicata pulvillis sub-40 aculeolos vaginatos elongatos 8–12 gerentibus dense stipata floris, rudimento subpersistente coronata; seminibus subregularibus s. angulatis, crassis, late commissuratis, cotyledonibus parallelis.

In the Colorado valley, near the mouth of Williams' river. Mr. Schott found a stouter form further south. The more northern plant forms a low shrub 6–18 inches high, spreading, and

often partially prostrate; the cylindric tubular wood is reticulated with short meshes. Joints 1–2½ inches long, less than 1 inch thick, tubercles not more than 4 or 5 lines long; bristles few and rather coarse; spines 12–20; the 4 larger ones are somewhat central, 9–12 lines long; the others radiating from 4–9 lines long; the smaller ones, as in all these *Opuntiæ*, hardly vaginate. Flower described from a withered specimen found attached to a fruit, to which it somewhat adhered, but perhaps held more by the long intricate spines than by an organic attachment. Flower 1½–1¾ inches in diameter, apparently yellow, which is uncommon among the *Cylindric Opuntiæ;* petals about 9 lines long and three broad, stigmata about 2 lines long. The fruit is very peculiar, and with the seed, characterizes this species well. The wide umbilicus on the shallow fruit gives it the appearance of a saucer, and the seeds find their place more around the edge of the umbilicus than in the body of the fruit. Spines on fruit from 4–10 lines long. Seed 2 lines or more in diameter, with a broader commissure than any of the allied species, cotyledons always, all the specimens examined regularly accumbent or parallel; the only species, so far, where this regularly is the case, albumen unusually large.

O. Serpentina, from San Diego, is very nearly allied to our species, but seems sufficiently distinct by its elongated cylindric joints and different growth.

21. O. Bigelovii, *Englm.:* caule arborescente erecto crasso reticulato-lignoso, ramis erectis adscendentibusve numerosis congestis, inferioribus demum refractis, articulis ovatis s. ovato-cylindricis tumidis læte s. pallide viridibus fragilibus; tuberculis subhemisphericis depressis confertis; pulvillis immersis ovatis setas pallidas penicillatas et aculeos 6–10 robustiores pallidos stramineo-vaginatos, 3 deflexos, ceteros divergentes et 6–10 graciliores inferiores radiantes gerentibus; ovario tuberculis plurimis stipato parce aculeolato; bacca ovata profunde umbilicata tuberculata pulvillos immersos 60–70 setigeros inermes s. aculeolos sub-3 vaginatos gerente; seminibus parvis.—(Plate XIX, fig. 1–7.)

On Williams' river, a branch of the Colorado; 10-12 feet high, stem ¾ inch in diameter; skeleton forming a large hollow tube, much reticulated with numerous small roundish or somewhat rhombic meshes in 13 or 21 spiral rows. Branches forming a dense head; younger joints erect, adpressed very fragile, often shaken off by the wind and covering the soil around, taking root everywhere, or sticking to the clothes of the passers-by like burrs. The joints on the older part of the stem are often persistent and reflexed, becoming withered and brown. Joints 2–6 inches long, 1–2 inches in diameter, light fresh green, covered with the small almost hemispherical, and not very prominent, tubercles, which are 3–4 lines long, and arranged mostly in 13 spirals; the areola is immersed at the apex of the tubercle, and surrounded by an elevated paler or almost whitish ridge, having the appearance of 2 lateral glands. Larger spines about 1 inch long. Flower or complete fruit not seen; an ovary or young fruit before me is clavate, 1 inch long, and has a few spines on the pulvilli; some empty (sterile?) fruits brought home are oval 1½–1¾ inches long, 1 inch in diameter, strongly tuberculated, and spineless; others again are even larger, with more numerous tubercles, and the pulvilli beset with 3–6 sheathed spines 4–7 lines long. These are evidently undergoing a change into joints; proliferous seeds, said to be small, but most unfortunately the specimens were lost, so that we were unable to compare them with those allied species found further south, (*O. fulgida,*) and on the Pacific coast, (*O. prolifera.*) Our plant is distinguished from these forms by its short tubercles, immersed pulvilli, and large tuberculated and somewhat spiny fruit.

[I have thought proper to consecrate this remarkable species, so conspicuous in its desert wilds, to my colaborer Dr. J. M. Bigelow, through whose intelligent exertions and indefatigable assiduity so many new Cactaceæ, described in this report, have been discovered and brought home.—G. E.]

22. O. Whipplei, (sp. nov.): caule erecto s. rarius patulo s. subprocumbente, reticulato-lignoso, divaricato ramoso, articulis cylindricis; tuberculis ovatis confertis, pulvillis pulvinatis

parce tomentosis vix setosis; aculeis brevibus cinereo s. stramineo vaginatis, 1—4 majoribus divaricatis, inferiore longiore deflexo, minoribus 2–8 solum ad inferiorem pulvilli marginem deflexis s. undique radiantibus; flore rubro, ovario ovato tuberculato pulvillis 20–30 tomentosis setas stramineas et aculeolos paucos mox deciduous gerentibus stipato sepalis tubi sub-8 orbiculatis cuspidatis, petalis 8–10 spathulatis cuspidatis; bacca subglobosa leviter tuberculata subcarnosa flava inermi; umbilico infundibuliformi seminum subregularium commissura lineari.

α. LÆVIOR humilior, aculeis brevioribus paucioribus seminibus minoribus.

β. SPINOSIOR elatior aculeis plurimis longioribus seminibus majoribus. (Plate XVII, fig. 1–4.)

From the elevated country about Zuñi to the head of Williams's river, at first seen only 8–15 inches high, subprostrate, afterwards 20–30 inches, and sometimes even 5–6 feet high. Var. *β.* was found by Mr. A. Schott south of the Gila river, and he also discovered the flower of this plant, which, like the flowers of all the other new species, remained unknown to us, unless winter remains were picked up here and there. Ligneous skeleton tubular, with small meshes, dense at base of stem; joints elongated, 2–4 inches to a foot long, $\frac{1}{2}$ or $\frac{3}{4}$ of an inch in diameter; tubercles ovate or sometimes almost rhombic, about 5 lines long; spines very variable in number, sometimes only with 1 larger and 2 or 3 smaller ones; in other instances, especially in Var. *β.*, with 12 or 14; spines 3–9 lines long, bristles few, generally only on older joints; flowers $1\frac{1}{4}$–$1\frac{1}{2}$ inches in diameter; ovary 6–9 lines long with 20 or 25 pulvilli; fruit about 1 inch long, a little less in diameter, somewhat fleshy and sweet, with 25–35 not very prominent tubercles; seeds with linear or almost linear commissure, $1\frac{1}{2}$–$1\frac{3}{4}$ lines in diameter; cotyledons regularly incumbent or sometimes oblique. The seeds of *β.* are 2 lines in diameter.

This is easily distinguished from all the allied species of the slender elongated branches, the short, crowded tubercles, and the short spines. We have dedicated this *Opuntia*, characteristic of the desert mountains under the 35th degree, between the Rio Grande and the Colorado, to Captain A. W. Whipple, the commander of the expedition who, by his zealous and liberal cooperation, afforded every facility in his power in the various collections of natural history. (Plate XVII, fig. 5–6, and Plate XVIII, fig. 4.)

23. O. ARBORESCENS, *Englm.*: found first 200 miles east of the Pecos, and from there abundantly as far west as Zuñi, where other cylindric *Opuntiæ* take its place. In this region it does not grow higher than 5–8 feet, and can scarcely be called arborescent; it is always well characterized by the verticillate often somewhat pendulous branches, the cristate-tuberculate spineless fruit, and the smooth seeds with a distinct and broadly linear commissure. Seeds of specimens collected at Zuñi smaller than others, only $1\frac{1}{2}$ line in diameter.

24. O. ACANTHOCARPA, (sp. nov.): caule arborescente erecto reticulato-lignoso, ramis adscendentibus divaricatis articulis cylindricis tuberculatis pallide virescentibus, tuberculis oblongo-linearibus pulvillis ovato-orbiculatis breviter tomentosis vix setosis, aculeis numerosis s. plurimis (8–25) stramineo-vaginatis undique porrectis, stellatis; bacca subglobosa late umbilicata tuberculata; pulvillis 12–15 tomentosis parce setosis aculeolis validis 8–10 munitis; seminibus magnis muetangulis late commissuratis. (Plate XVIII, fig. 1–3.)

On the mountains of Cactus Pass, about 500 miles west of Santa Fé. Stout, stem 5–6 feet high, wood forming a hollow reticulated tube, solid at base; branches few, never verticillate, separating at acute angles; joints 4–6 inches long, 1 inch in diameter, tubercles 9–10 lines long; pulvilli in some with one central and 6 or 8 exterior spines, in others with 3–7 interior and 10–20 exterior stellately radiating spines. Central spines 1–$1\frac{1}{4}$ inch, exterior 4–10 lines long, with a yellowish or brownish sheath. Fruit 1 inch long with a large but not deep umbilicus, and 12–15 rather shallow tubercles; spines of fruit stout, 3–6 lines long, stouter and more crowded toward the top of the fruit. Seeds unlike any other of our *Opuntiæ*, $2\frac{1}{2}$–3 lines in diameter, with rather broad commissure, often spongy on the margin, and on the sides with many even or concave faces separated by sharp ridges.

This peculiar species cannot be confounded with any other, but comes, in the arrangement of spines, nearest to *O. arborescens*, from which it is easily distinguished by its manner of growth, its elongated tubercles, and especially the much less tuberculated and spiny fruit, and the peculiar seed.

25. O. TESSELATA, Englm.: caule frutescente erecto s. diffuso, dense lignoso, ramosissimo, ramis divaricatis, articulis gracilibus teretibus, plano-tuberculatis cæsiis, tuberculis 5–6 angulatis confertissimis depressis, planiusculis; pulvillo lineari tomentoso vix setis paucis deciduis instructo, inermi s. medio s. versus basin aculeo elongato porrecto s. subdeflexo albido flavido s. fulvo vagina laxi basi constricta flava s. e flavo fulva indusiato, singulo s. rarissime binis; aculeis paucis brevibus setaceis infra sæpe adjectis; floris purpurei ovario obovato s. clavato pulvillis 30–50 villoso-tomentosis inermibus s. parce aculeolatis dense stipato; sepalis tubi sub-8 obovato-orbiculatis cuspidatis petalis 5 late obovato-orbiculatis emarginatis; filamentis exterioribus latioribus persistentibus, stigmatibus 5 brevibus ovatis adpressis; bacca ovata basi apiceque contracta sicca pulvillis villosis aculeo-latissimus confertissimis stipata, floris rudimentis coronata; seminibus subregularibus margine spongioso crasso parum prominente cinctis. *O. ramosissima*, E. in Sill. Journ., November, 1852. (Plate XXI, figs. 1–7.)

Valley of the Lower Colorado, and from thence to the California mountains; first discovered by Dr. Parry in the Colorado desert, afterwards found by Dr. Bigelow from the valley of Williams' river to 70 miles east of Cajon Pass, in the California mountains. The flower was first noticed by Mr. A. Schott, in western Sonora, towards the Lower Colorado. Fl. May to September. Stems 2–6 feet high, mostly branching from the base below, 1–3 inches in diameter, covered with a dark-gray scaly bark; wood of young branches reticulate, very soon becoming solid, but even then the reticulated structure remains visible in the different layers of wood. Annual layers not as distinct as the medullary rays, but more so than in *O. frutescens;* in a stem of near 2 inches diameter we counted 35 annual layers, 8 or 9 of which belong to the alburnum; branches numerous and slender, of an ashy or grayish green color, younger ones 3 or $3\frac{1}{2}$ lines in diameter, well characterized by the remarkable flattened tubercles, which, by closely crowding together, become 5 or 6 angular, diamond-shaped; the areola is linear, extending down to the middle of the tubercle; its short tomentum usually extends upwards between the next adjoining tubercles. Tubercles $2\frac{1}{2}$–3 lines long, and a little less in diameter. Spines $1\frac{1}{2}$–2 inches long, usually from the middle or at least above the base of the pulvillus, generally only on the upper tubercles of each year's growth, which gives the whole plant a singular appearance, showing the fasciculate spines at some, and having no spines at all on other parts of the apparently homogeneous branches. Sheath contracted at base, and firmly adhering to the spine, loose and saccate above. Small bristly spines at the base of the pulvillus, 2–3, sometimes even 5 in number, 1–4 lines long. Flower purple, about 6 lines in diameter, lowest part of the tube naked. Fruit 9–10 lines long, resembling much the fruit of the *Clavate Opuntiæ* in shape, being contracted above, with a narrow and deep umbilicus, and retaining the dead remains of the flower, of which the broad, scale-like exterior filaments are most conspicuous; pulvilli large and woolly, almost entirely covering the fruit, and beset with 30 to 50 reddish-brown, bristly, flexuous spines, 2–3 lines long. Seeds few, regular, nearly or quite 2 lines in diameter.

O. VAGINATA, Englm.: caule frutescente erecto dense lignoso, ramis virgatis demum teretibus junioribus tubercula oblongo-elongata subprominentia gerentibus læte viridibus; foliis subulatis pulvillis orbiculatis magnis breviter albo-tomentosis, setarum straminearum penicilla paro brevi, aculeis ex imo pulvillo singulis elongatis corneis s. fuscis laxe stramineo s. aurantiaco-vaginatis, adjectis subinde supra aculeis minoribus 1–2; bacca ovata tuberculata pulposa flava pulvillos 15–20 majusculos albo-tomentosos setosos gerentibus, umbilico angusto immerso, seminibus subregularibus marginatis. (Plate XX, fig. 1.)

About Albuquerque, where Dr. Wislizenus had already collected it in 1846; apparently extending into Mexico, as Dr. Gregg collected what seems to be the same species about San Luis Potosi. Shrub 3–5 feet high; lower part of stem 1–1½ inch thick, covered with scaly, light-yellowish-brown bark; older branches smooth terete, younger ones 3–4 lines in diameter, strongly tuberculated; tubercles 6–9 lines long; leaves slender, about 3 lines long, and apparently somewhat persistent, as they are sometimes found adhering, though withered, even to fruit-bearing branches, which, of course, are over a year old. The same, though to a less extent, is sometimes seen in *O. frutescens*. Pulvilli unusually large; bristles in the young ones forming a small but distinct bunch at the upper edge of the areola, but disappearing on the older joints, contrary to the usual occurrence, when the bristles become stouter and more numerous in older joints. Spines 1–2½ inches long, dark, with very loose and glistening sheaths; second or smaller spine sometimes lateral, but usually above the principal one, not below it, as in most others. Flower unknown. Fruit ovate, 8 or 9 lines long, the pulvilli often bear 2–5 obtuse bodies, almost hidden in the tomentum, apparently glandular, but of a fibrous structure. Seeds, 12–15 in each fruit, about 2 lines or a little more in diameter, commissure broad, prominent, forming a distinct, somewhat spongy, rim. (See plate XX, fig. 1, and plate XXIV, figs. 13–15.) In Dr. Wislizenus' report, the long-spined form of *O. frutescens* was confounded with this species. It is possible, however, that *O. vaginata*, as described here, may be a stouter, tuberculated form of *O. frutescens*, with lighter colored, tuberculated fruit, and larger seed.

27. O. FRUTESCENS, Engelm. This well known species was observed from Laguna Colorado, 60 miles east of the Pecos, to Williams' river, a branch of the great Colorado, always with the same characters. The bark is scaly, almost papery, with a silvery reflection; the wood shows the medullary rays very distinctly, especially 5 of them; much less the annual layers. Fruit deep scarlet, smooth, small, sometimes almost obliterated pulvilli, 5–9 lines long; seeds 5–10, about 1½ lines in diameter, with a narrow and often acute margin. The forms collected on the expedition belong to var. *α. longispina;* the var. *β. brevispina* has been observed only in Texas and northeastern Mexico. (See Plate XX, fig. 2–5, and Plate XXIV, fig. 16–19.)

EXPLANATIONS OF THE PLATES OF CACTACEÆ.

Pl. I. Echinocactus Whipplei, E. & B.: fig. 1, whole plant; fig. 2, bunch of spines of the usual size; fig. 3, same, uncommonly large and broad; fig. 4, same, lateral view; fig. 5, same, very young; fig. 6, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to exhibit the tuberculated appearance.

Pl. II, Fig. 1–2. Echinocactus polyancistrus, E. & B.: 1, upper part of a rib with older and younger bunches of spines, the youngest one with a flower bud in the axil; 2, one of the largest and most fully developed bunches of spines.

Fig. 3–5. Echinocactus Le Contei, E.: 3, part of a rib, with 2 bunches of spines; 4, a single bunch of spines from another specimen; 5, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to exhibit the oval pits.

Pl. III, Fig. 1–2. Echinocactus Wislizeni, E.: 1, side view of a bunch of spines; 2, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to exhibit the reticulation. This species, collected by Captain Whipple on the Gila, and common about El Paso, on the Rio Grande, has been introduced here to show those characteristics which distinguish it from the nearly allied *E. Le Contei*, on the foregoing plate.

Fig. 3. Echinocactus Emoryi, E.: two bunches of spines on part of a rib.

Fig. 4–6. Echinocactus polycephalus, E. & B.: 4, part of a rib, with 3 bunches of short, stout, and straightish spines; 5, a young bunch of spines of unusual dimensions and much curved, with a woolly fruit in the axil; 6, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface more magnified to show the warty appearance, *d* seed after the removal of the outer integument, embryo, together with a considerable quantity of albumen in the endopleura, *e* embryo curved with accumbent cotyledons.

Pl. IV, Fig. 1–3. Cereus phœniceus, E.: 1, upper part of a head bearing a flower; 2, a bunch of spines of the usual size; 3, part of a rib, with 3 bunches of spines from an uncommonly large form.

Fig. 4–5. Cereus phœniceus, sub. sp. conoideus, E. & B.: 4, upper part of a head; 5, part of a rib, with 2 bunches of spines.

Fig. 6–7. Cereus triglochidiatus, E.: 6, upper part of a large head, with a flower; 7, part of a rib of another specimen, with smaller curved spines.

Fig. 8. Cereus Mojavensis, E. & B.: part of a rib, with 3 bunches of spines.

Fig. 9. Cereus Mojavensis, E. & B., var. zuniensis: part of a rib, with 2 bunches of spines.

Pl. V, Fig. 1. Cereus hexædrus, E. & B.: upper part of a head.

Fig. 2–3. Cereus gonacanthus, E. & B.: 2, part of a rib, with two bunches of spines; 3, another fascicle of spines; the 3 bunches of spines show all a different proportion of the central and the upper radial spines.

Fig. 4–7. Cereus Engelmanni, var. variegatus, E. & B.: 4 and 5, two bunches of spines, showing a different arrangement of central spines; 6, fruit; 7, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to show the irregular tuberculation.

Fig. 8–10. Cereus Engelmanni, var. chrysocentrus, E. & B.: 8, part of two ribs, with numerous spines; 9, a single bunch of spines; 10, fruit, sterile and perhaps not fully developed.

Pl. VI, Fig. 1–3. Opuntia chlorotica, E. & B.: 1, joint with a flower. The flower to be reconstructed from a withered specimen collected in January; 2, sterile and probably unde-

veloped fruit; 3, fragment of the bark of the lower part of the plant, with several large bunches of spines.

Fig. 4–5. Opuntia procumbens, E. & B.: 4, part of a joint; 5, larger bunch of spines from another specimen.

Pl. VII, Fig. 1–2. Opuntia occidentalis, E. & B.: 1, joint of the usual shape and size; 2, fruit.

Fig. 3–4. Opuntia angustata, E. & B.: 3, a large and less spinous joint with a sterile degenerate spinous fruit; 4, a smaller, more spinous joint with a full grown ripe fruit.

Pl. VIII, Fig. 1. Opuntia Engelmanni, var. cyclodes, E. & B.: with ripe fruit.

Fig. 2–3. Opuntia tortispina, E. & B.: 2, fragment of a joint with fewer spines and ripe fruit; 3, part of a more spiny joint.

Pl. IX, Fig. 1–5. Opuntia camanchica, E. & B.: 1, a joint with shorter and lighter colored spines; 2, a joint with larger and darker spines; 3, fragment of a joint with more numerous an, docwded spines; 4 and 5, ripe fruit of the smaller and largest size.

Fig. 6–8, Opuntia mojavensis, E. & B.: 6, a younger bunch of spines · 7, another from the oldest part of the plant; 8, a sterile and degenerate fruit.

Pl. X. Fig. 1–2. Opuntia vulgaris, Mill.: 1, a young joint with leaves, the older one has a single spine and bears, a flower bud; 2, a single leaf magnified 4 diameters. The figures of this species have been introduced to exhibit the diagnostic characters and its difference from the next species.

Fig. 3–5. Opuntia Rafinesquii, E.; 3, an older joint with a flower and a bud, and a younger half-grown joint with leaves. This represents the spinous form common in Illinois, Missouri, and Arkansas. 4, an older joint of the variety with few spines, bearing numerous fruits of different shapes, as they often occur in the same plant; 5, two leaves of different sizes magnified 4 diameters.

Pl. XI, Fig. 1, Opuntia Rafinesquii, var. minor, E.: the larger joint spineless, the upper one spiny on the margin.

Fig. 2–3. Opintia Rafinesquii, var. grandiflora, E.: 2, a joint with flower; 3, fruit.

Fig. 4. Opuntia fuscoatra, E.: a joint with a young fruit just after flowering, fragment of an older, very bristly, joint visible.

Pl. XII. Fig. 1–3. Opuntia cymochilas, E. & B.: 1, a joint; 2, a single bunch of spines; 3, ripe fruit.

Fig. 4–6. Opuntia stenochila, E. & B.: 4, a joint; 5 and 6, a smaller and large fruit.

Fig. 7–8. Opuntia fusiformis, E. & B.: 7, a joint; 8, a fruit.

Fig. 9. Opuntia bracayarthra, E. & B.: a whole plant with two withered flowers.

Pl. XIII. Fig. 1–5. Opuntia basilaris, E. & B.: 1, a joint somewhat shrivelled as it appears in winter; a late young joint near its base appears more plump and fresh; 2, flower; 3, style; 4, undeveloped sterile fruit; 5, a whole plant reduced in size to show the singular manner of growth.

Fig. 6–7. Opuntia sphærocarpa, E. & B.: joint and fruit.

Fig. 8–11. Opuntia erinacea, E. & B.: 8, joint of the usual shape, (only partly finished;) 9 and 10, bunches of spines; 11, fruit.

Pl. XIV. Fig. 1–3. Opuntia Missouriensis, var. rufispinis, E. & B.: 1, a joint, (only partly completed;) 2, a very full bunch of spines; 3, fruit.

Fig. 4. Opuntia Missouriensis, var. platycarpa, E.: fruit.

Fig. 5–7. Opuntia Missouriensis, var. microsperma, E.: 5, joint (unfinished) with flower; 6, bunch of spines; 7, fruit.

Fig. 8–10. Opuntia Missouriensis, var. albispina, E. & B.: 8, joint (unfinished); 9, bunch of spines; 10, fruit.

Pl. XV, Fig. 1–4. Opuntia Missouriensis, var. trichophora, E. & B.: 1, part of an old stem

showing the thickness and hairy spines, upper younger joints (unfinished); 2, bunch of spines from a younger joint; 3, same from an older part of the plant; 4, fruit.

Fig. 5–7. Opuntia hystricina, E. & B.: 5, a joint (unfinished); 6, a large bunch of spines; 7, fruit.

Pl. XVI. Opuntia Davisii, E. & B.: 1, a branch showing the structure of the older parts, an older and young joints with two fruits; 2, a tubercle with its bunch of spines, the membranaceous sheaths partly torn, showing the spine itself; 3, a degenerate sterile spiny fruit in its transition to a branch, as it is often seen in this species and others, especially cylindric opuntia; 4, the whole plant reduced.

Pl. XVII, Fig. 1–4. Opuntia Whipplei, E. & B.: 1, a branch of the more common form of the plant covered with ripe fruit. At (*a*) the fruit is undeveloped, probably not different from the ovary of the flower, only more shrivelled; 2, branch of a larger specimen, spines more numerous, fruit larger; 3, a single bunch of spines of this specimen; 4, whole plant reduced.

Fig. 5–6. Opuntia arborescens, E.: 5, a stout branch with numerous spines and large fruit; 6, a bunch of spines of same.

Pl. XVIII, Fig. 1–3. Opuntia acanthocarpa, E. & B.: 1, an older branch with fruit; 2, a young branch; 3, whole plant reduced.

Fig. 4. Opuntia arborescens, E.: whole plant reduced.

Fig. 5–10. Opuntia echinocarpa, E. & B.: 5, a branch of the plant densely covered with the sheathed spines; 6, 7, and 8, bunches of spines; 9, fruit, side view; 10, same, top view.

Pl. XIX. Opuntia Bigelovii, E.: 1, a single joint; 2 and 3, tubercles, with bunches of spines; 4, young undeveloped fruit; 5, an apparently full-grown fruit, sterile, and perhaps degenerating into a branch; 6, part of the ligneous skeleton, forming a wide tube, and showing in the reticulated structure the traces of the tubercles and branches; 7, an entire plant reduced; on the left of the main stem is a younger shoot, with vigorous erect joints.

Pl. XX, Opuntia vaginata, E.: 1, an older joint bearing two fruits, and a young vigorous shoot.

Fig. 2–3. Opuntia frutescens, E., var. longispina: from Williams' river of the Colorado; 2, a branch with fruit; 3, lower part of the trunk, with some roots; the sections show the structure of the dense wood.

Fig. 4–5. Opuntia frutescens, E., var. brevispina: 4, a branch with fruits, most of them sterile, one producing young branches from its upper areola; 5, a flower.

Pl. XXI. Opuntia tesselata, E.: 1, a branch with fruit *a*, *a*, and a withered flower *b*; 2 and 3, flowers as they probably are reconstructed from withered specimens; 4, a small joint magnified so as to show distinctly the appearance of the tubercles and areolæ; 5, part of the stem with a section of the wood above and a fracture below, so as plainly to show the ligneous structure; the bark of the younger branches exhibits the tesselated surface, while in the older trunk it is lost in the irregular scales; 6, ligneous skeleton of a young branch; 7, a whole plant reduced.

Pl. XXII, Fig. 1–3. Opuntia clavata, E: 1, joint with a ripe fruit; 2, one of the upper bunches of spines; 3, part of the central spine magnified 4 diameters.

Fig. 4–7. Opuntia Parryi, E: 4, joint with ripe fruit; 5, bunch of spines, side view; 6, another one, front view; 7, part of the central spine magnified 4 diameters.

The remaining figures of this and all the two following plates represent seeds and their details of almost all the *Opuntiæ* described in this report. Fig. *a* represents a side view of the seed, natural size; *b*, same, four times magnified, as are all the following figures; *c*, posterior view; *d*, anterior view; *e*, vertical section of seed, exhibiting the position and proportion of the embryo and the albumen; *f*, embryo and albumen coated by the endopleura, after the removal of the testa; *g*, lateral view of embryo. The other letters *h*, *i*, *k*, etc., will be explained wherever they occur.

FIG. 8–9. Seeds of OP. ENGELMANNI, var. CYCLODES.

FIG. 10. Seed of OP. OCCIDENTALIS: One of the embryos, *g*, shows the cotyledons in an oblique almost incumbent position.

FIG. 11. Seed of OP. ANGUSTATA.

FIG. 12–15. Seeds of OP. CAMANCHICA, of different sizes and shapes.

PL. XXIII, Fig. 1–5. Seeds of OP. TORTISPINA: 1–3, seeds of different sizes and shapes; 4, two embryos in one seed; *g–h*, different views of both embryos together as they lay in the seed; *i*, interior layer, and *k*, exterior smaller embryo; 5, germination of a double embryo; two young plants from one seed, the larger one still bearing the shell of the seed.

FIG. 6. Seed of OP. FUSIFORMIS.

FIG. 7–12. Seeds of OP. RAFINESQUII, and some of its varieties and sub-species; 7, usual form from Missouri, (see pl. X, fig. 3;) *h*, *i*, *k*, germination in different stages of development; *l*, seedling with three cotyledons.

FIG. 8. Small seed from the fruit, (represented on pl. X, fig. 4.)

FIG. 9. OP. STENOCHILA.

FIG. 10–12. OP. CYMOCHILA: 10 and 11, different forms of the usual variety; 12, seed of the variety *montana*.

FIG. 13. Seed of OP. VULGARIS.

FIG. 14. Seeds of OP. BASILARIS: An irregular and a very regular one from the same fruit.

FIG. 15. Seed of OP. HYSTRICINA.

FIG. 16–19. Seeds of different forms of OP. MISSOURIENSIS: 16, var. RUFISPINA 17, var. PLATYCARPA; *h*, seedling of same; 18, var. ALBISPINA; 19, var. TRICOPHORA.

PL. XXIV, Fig. 1–2. OP. MISSOURIENSIS: 1, var. with smaller fruit and seeds from the Upper Missouri; 2, var. MICROSPERMA. (See pl. XIV, Fig. 5–7.)

FIG. 3. Seed of OP. SPHÆROCARPA.

FIG. 4. Seed of OP. ERINACEA: The embryo, *g*, shows considerable obliquity of the cotyledons.

FIG. 5. Seed of OP. FRAGILIS: From the Yellowstone river.

FIG. 6. Seed of OP. CLAVATA: The embryo, *g*, oblique.

FIG. 7. Seed of OP. PARRYI: Embryo, *g*, nearly accumbent.

FIG. 8. Seed of OP. ECHINOCARPA: One of the seeds quite regular, the other irregular; embryo, *g*, *g*, always regularly accumbent; *h*, and *i*, seedlings with the very narrow and thick cotyledons crossing each other, one of them bearing the shell of the seed.

FIG. 9–10. Seeds of OP. WHIPPLEI: 9, seed of the plant represented Pl. XVII, fig. 2, seed larger, commissure perfectly linear, cotyledons oblique; 10, seeds of the other specimen, Pl. XXII, fig. 1, seeds smaller, of different shapes, commissure a little wider, cotyledons oblique, in *i* somewhat separated; in *k* three cotyledons, of which *l* is a transverse section, *h*, seedling with very narrow and long cotyledons.

FIG. 11. Seeds of OP. ACANTHOCARPA, of different shapes all from one fruit.

FIG. 12. Seeds of OP. ARBORESCENS, of different shapes belonging to the plant, figured Pl. XVII, fig. 5, smaller than those sent by other collectors, embryo *g*, regularly incumbent.

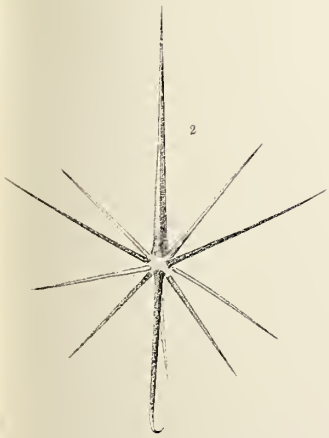
FIG. 13–15. Seeds of OP. VAGINATA: 13–14, seeds of different sizes from the plant, Pl. XX, fig. 1., the smaller one is empty and perhaps not fully formed; 15, seed of the same species collected in Mexico by Dr. Gregg. Cotyledons regularly incumbent.

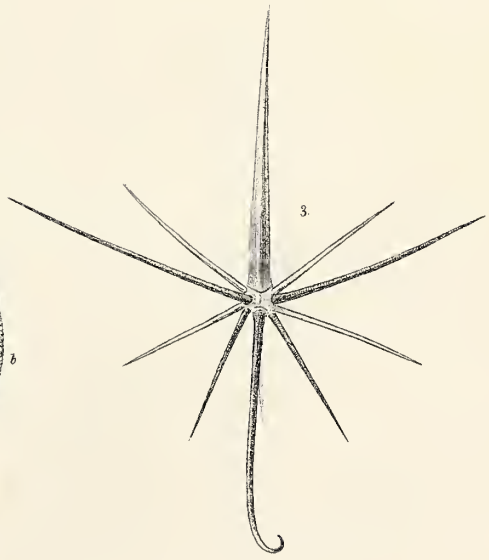
FIG. 16–19. Seeds of OP. FRUTESCENS: 16, var. LONGISPINA from the Llano Estacado (Pl. XX, fig. 2); 17, same from Mexico Dr. Gregg; 18, same from Williams River branch of the great Colorado; 19, var. BREVISPINA, from Texas, Lindheimer. In all these the cotyledons of the embryo are regularly incumbent.

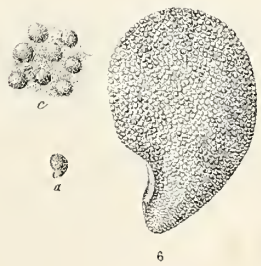
FIG. 20. Seeds of OP. TESSELATA: embryo oblique or almost accumbent.

All the figures are of natural size unless the contrary is expressly stated. They were drawn with the greatest accuracy, partly from living and in part from dried specimens, by Mr. Paulus

Roetter of St. Louis, under the personal superintendence of Dr. Engelmann. The drawings made on the spot by Mr. H. B. Möllhausen, the artist of the expedition, greatly aided the work and were made use of, and even partly copied, especially in the plates exhibiting the Cylindric Opuntiæ.





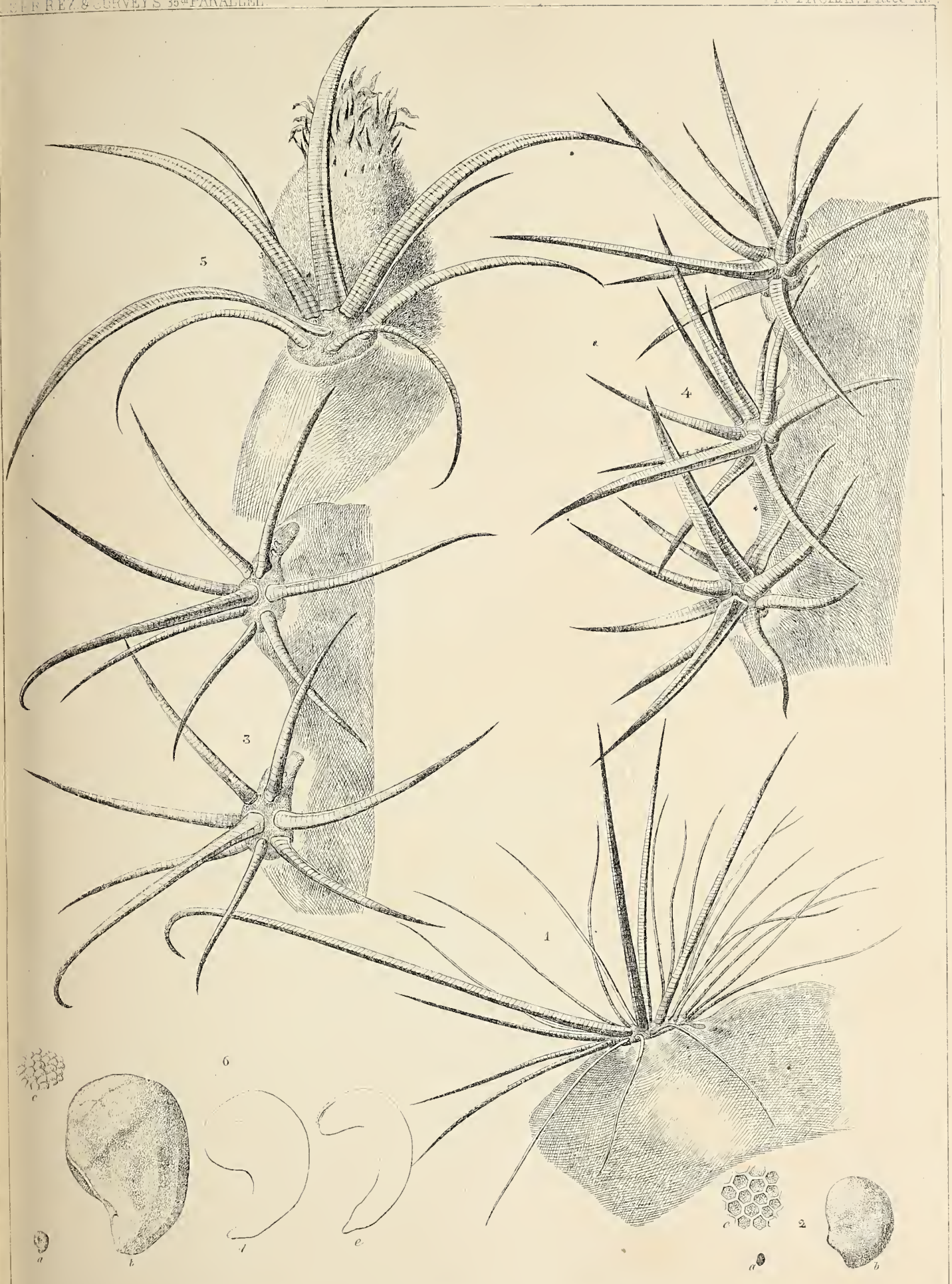


Ackerman Lith 379 Broadway NY

ECHINOCACTUS WHIPPLEI E & B.

Ackerman Lith. 379 Broadway N.Y.

1-2 ECHINOCACTUS POLYANCISTRUS, E&B. 3-5 ECHINOCACTUS LECONTEI. E.

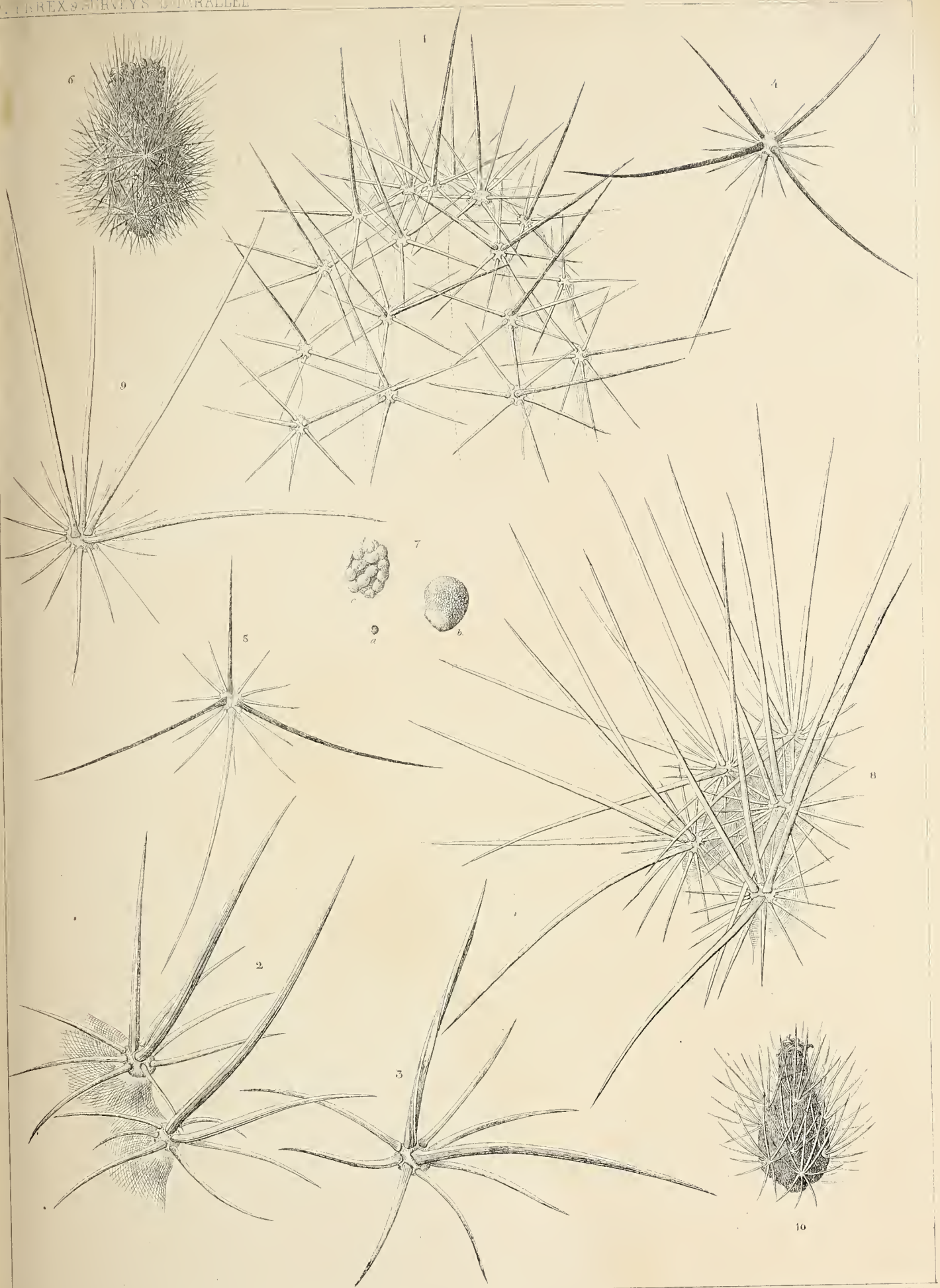


Lizerman, Lith. & Print. N.Y.

1 & 2 E. TRICOCYTUS WISLIZENI, N. 3 E. EMORYI, E. 4 & 5 E. POLYCEPHALUS, L. & B.

Ackerman Lith. 379 Broadway N.Y.

1-3. CEREUS PHŒNICEUS, E. 4-5. CEREUS CONOIDEUS E & B. 6-7. CEREUS TRIGLOCHIDIATUS. E.
8. C. BIGELOVII. 9. C. BIGELOVII β. ZUNIENSIS.

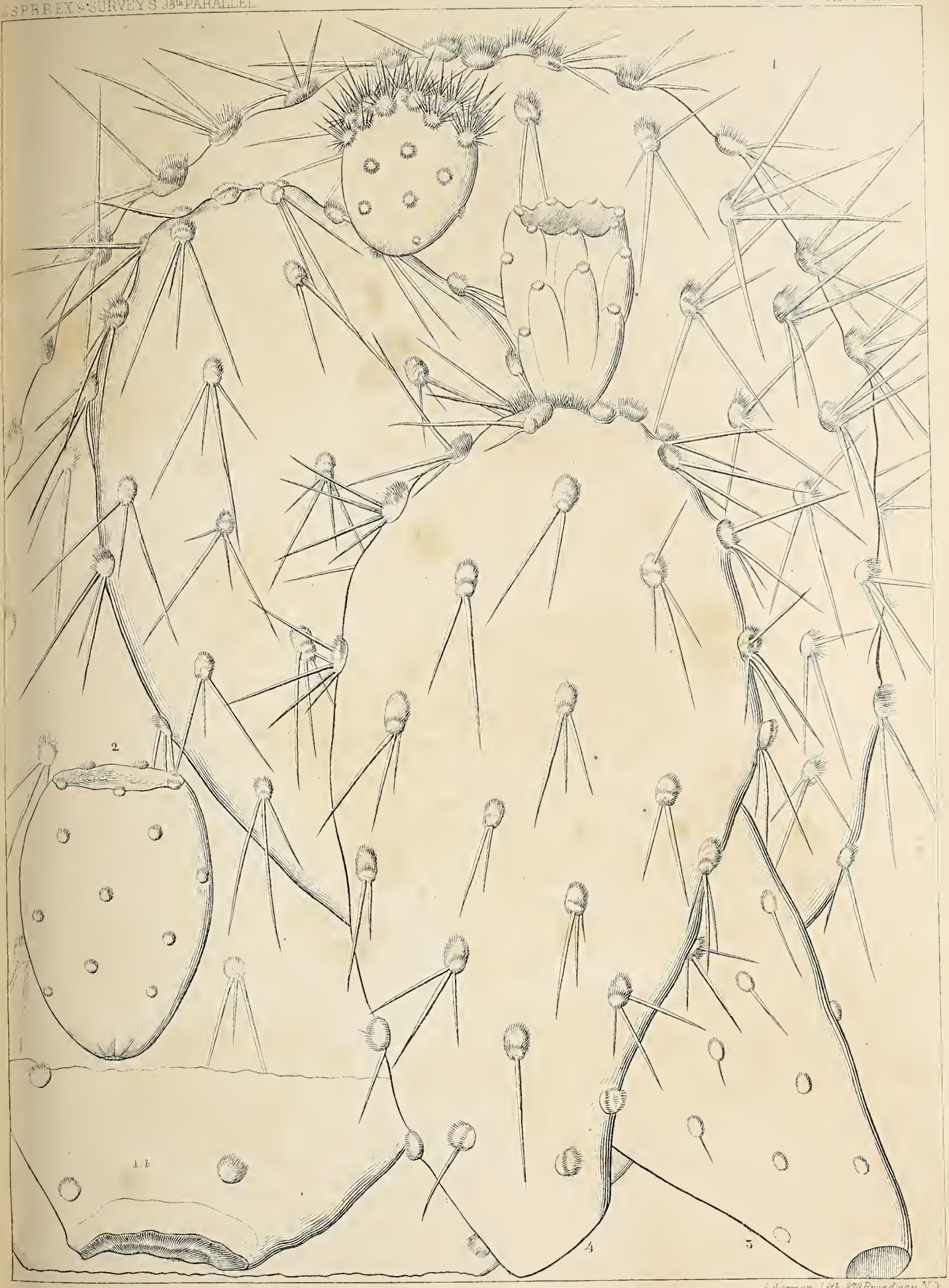


Ackerman Lith. 379 Broadway N.Y.

1 CEREUS HEXAEDRUS. E&B. 2 3 C. GONACANTHUS E&B. 4 7. C ENGELMANNI. var VARIEGATUS.
8-10 var CHRYSOCENTRUS

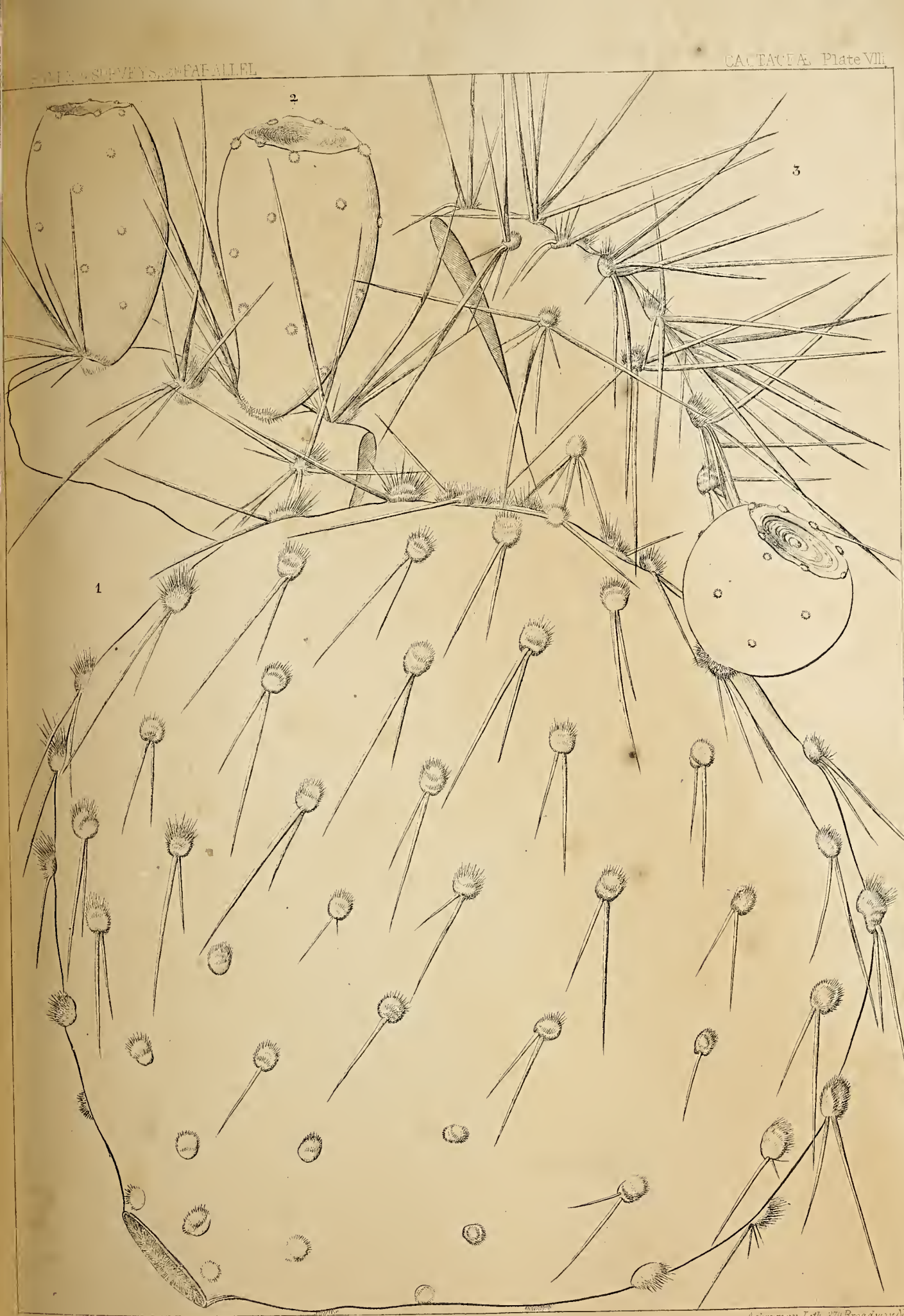
Ackerman Lith. 379 Broadway N.Y.

1~3 OPUNTIA CHLOROTICA, E & B. 4~5 O. PROCUMBENS, E & B.



Ackerman Lith. 379 Broadway N.Y.

1. 2. OPUNTIA OCCIDENTALIS, E & B. 3. 4. O. ANGUSTATA, E & B.



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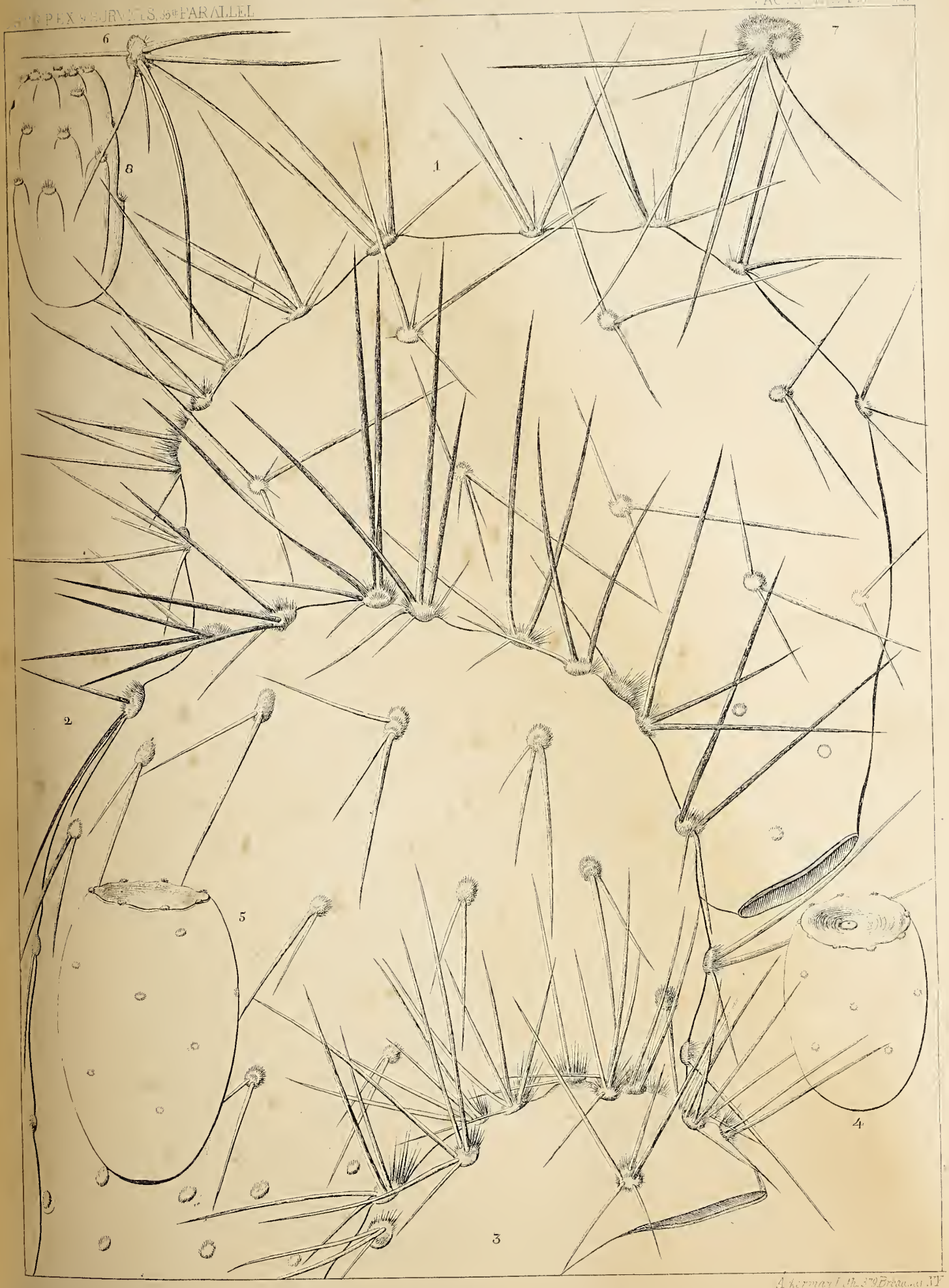
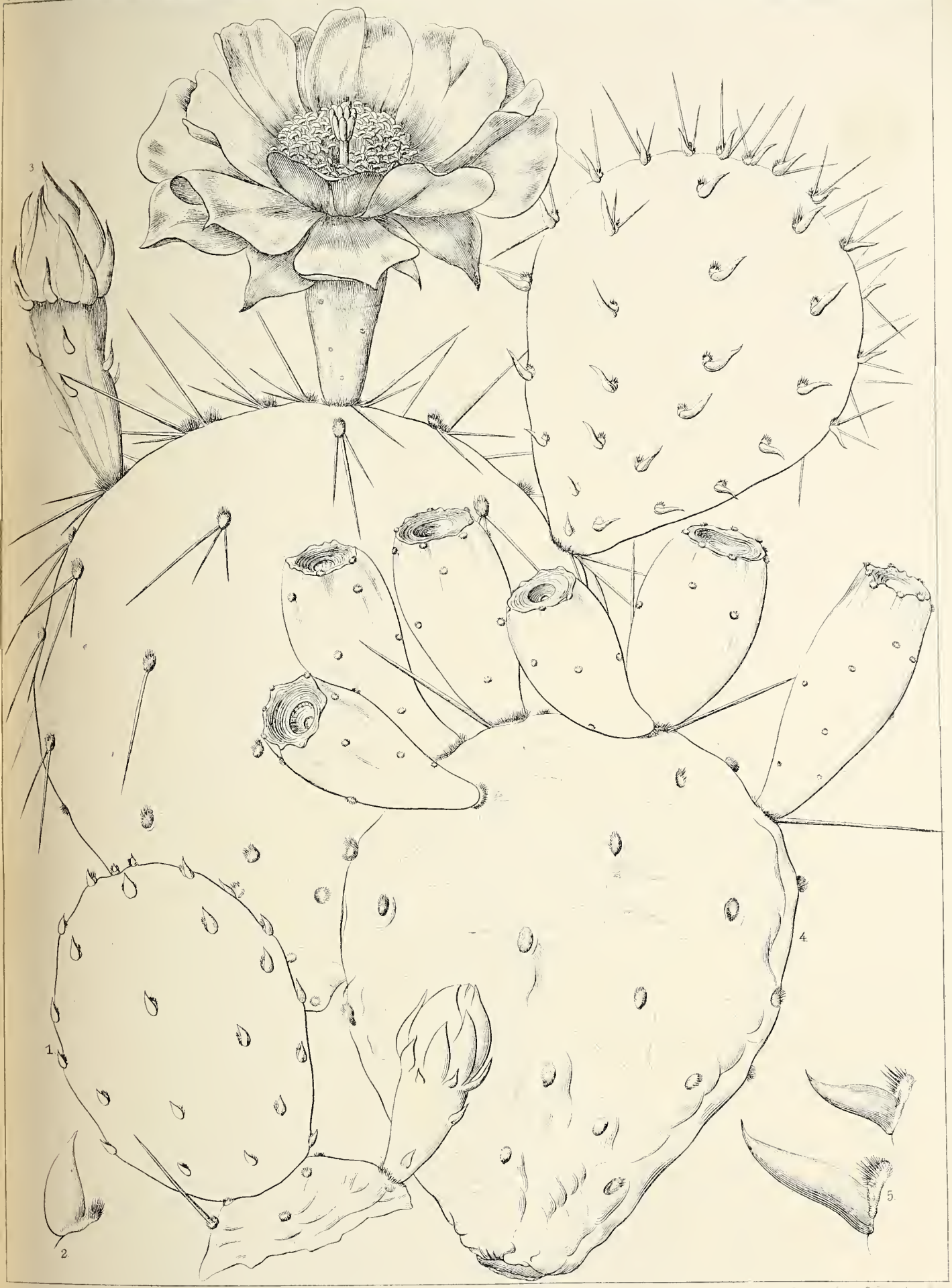
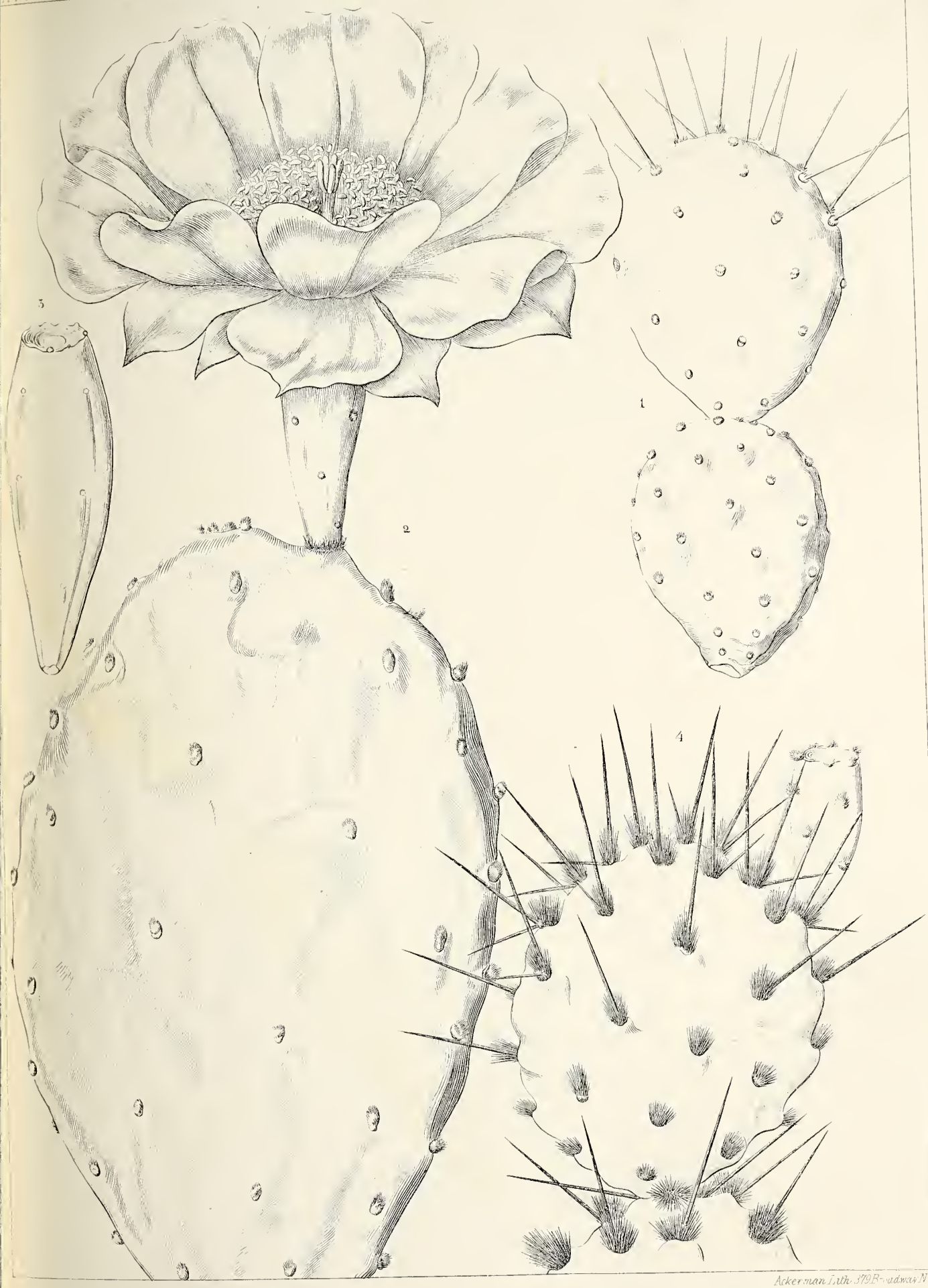


A. Kerrmann Lith. 379 Broadway N.Y.

1-5, OPUNTIA CAMANCHICA, E & B. 6-8, OPUNTIA MOHAVENSIS, E & B.

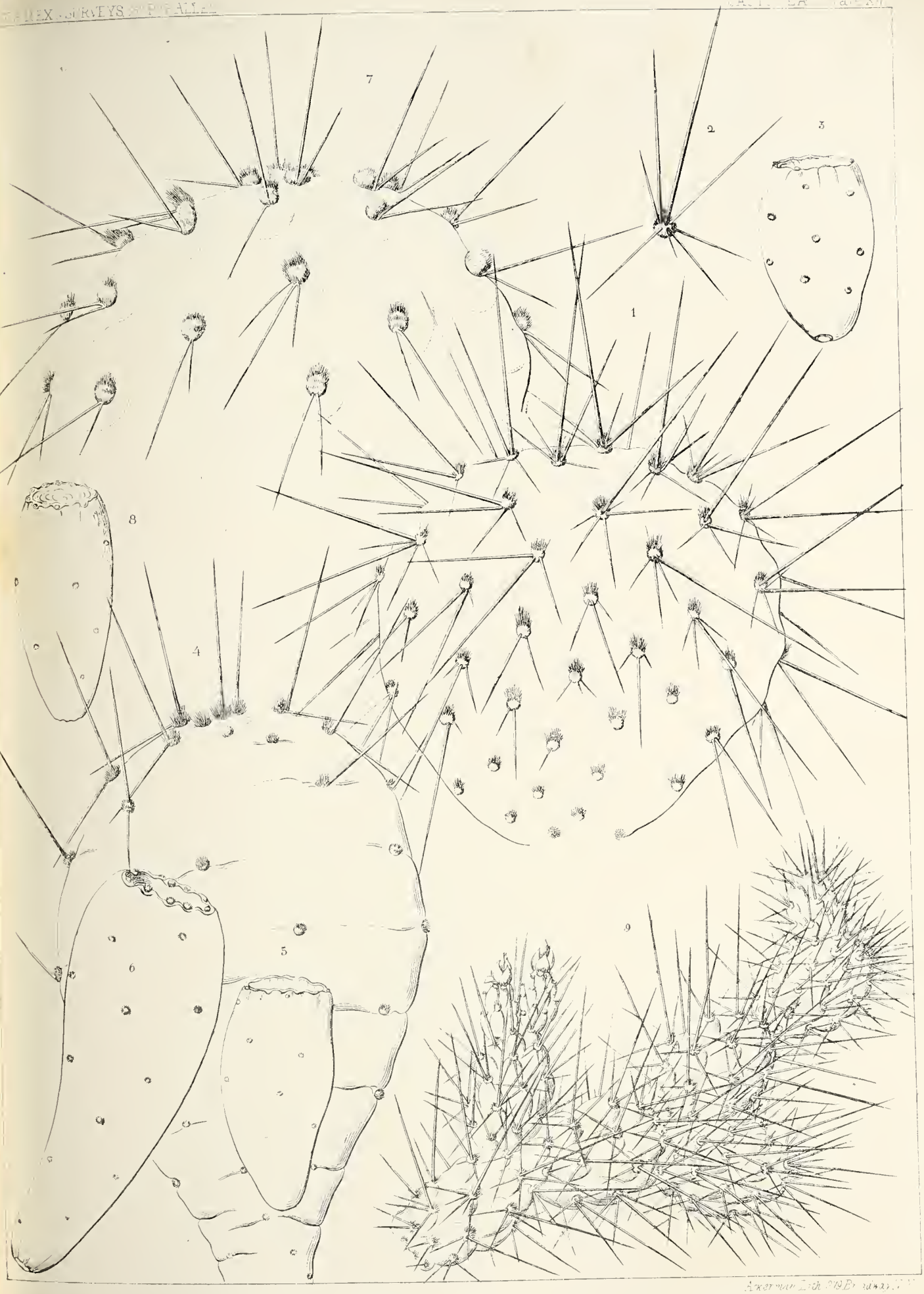


1-2 OPUNTIA VULGARIS, *Mill.* 3-5 OP. RAFINESQUII, E.



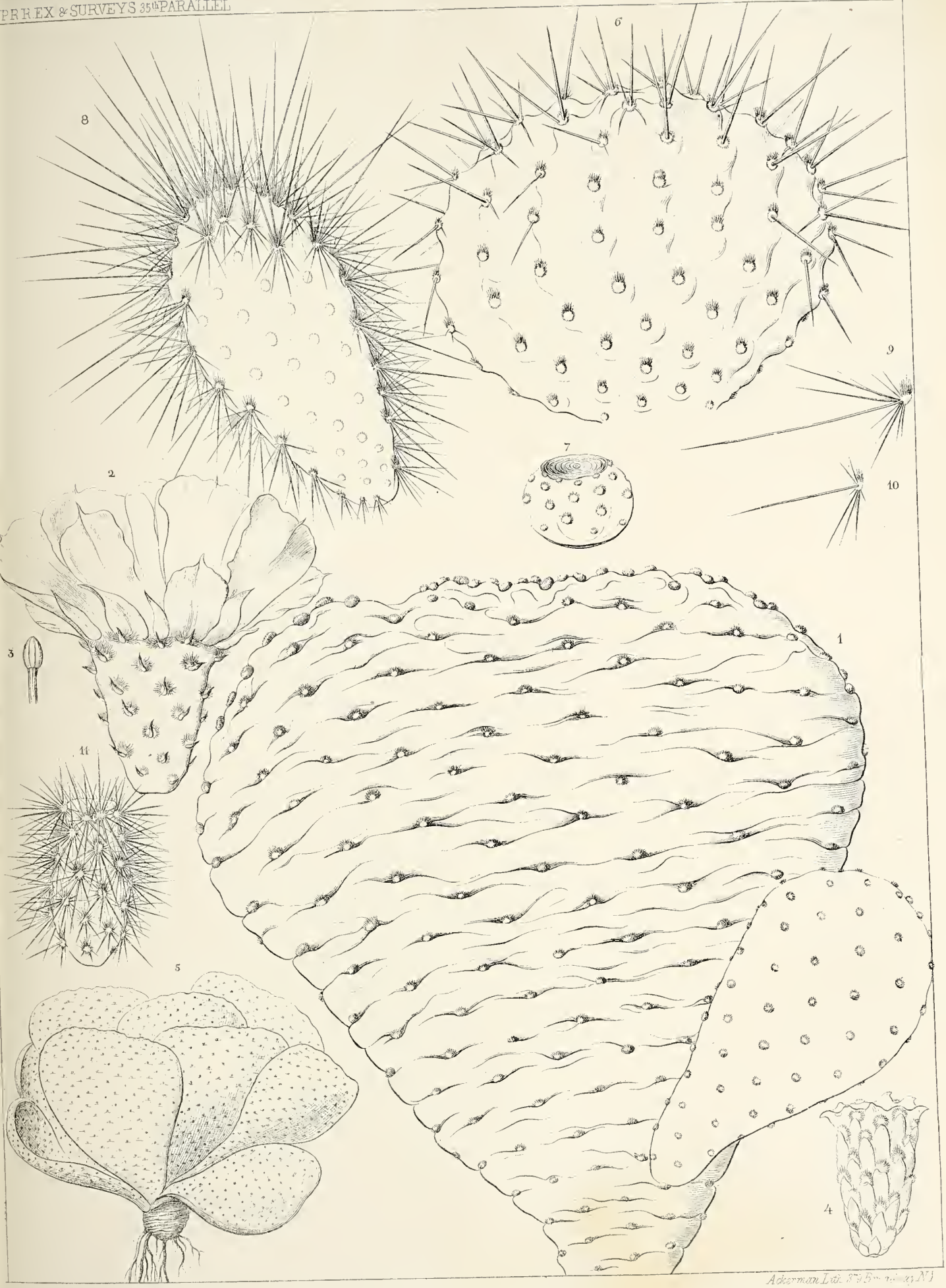
Ackerman Lith. 379 Broadway N.Y.

1. OPUNTIA RAFINESQUII, *minor*, E. 2-3 OP RAFINESQUII, *grandiflora* E.
4 OPUNTIA FUSCO-ATRA. E.



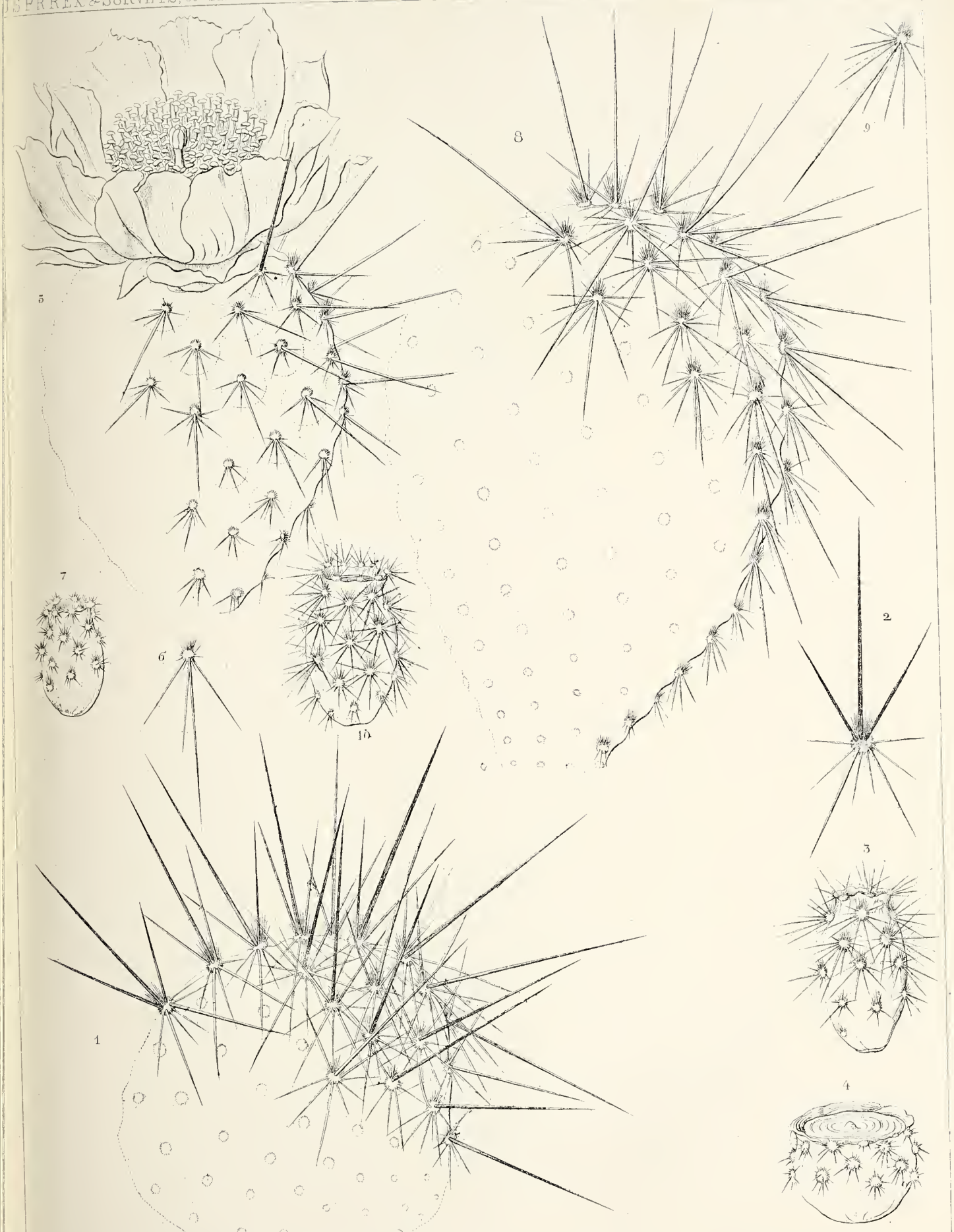
Ackermann Lith. 68 Beekman St. N.Y.

1-3. OPUNTIA CYMOCHILA, E&B. 4-6 OPUNTIA STENOCHILA, E&B 7-8 OPUNTIA FUSIFORMIS E&B
9. OPUNTIA BRACHYARTHRA E&B



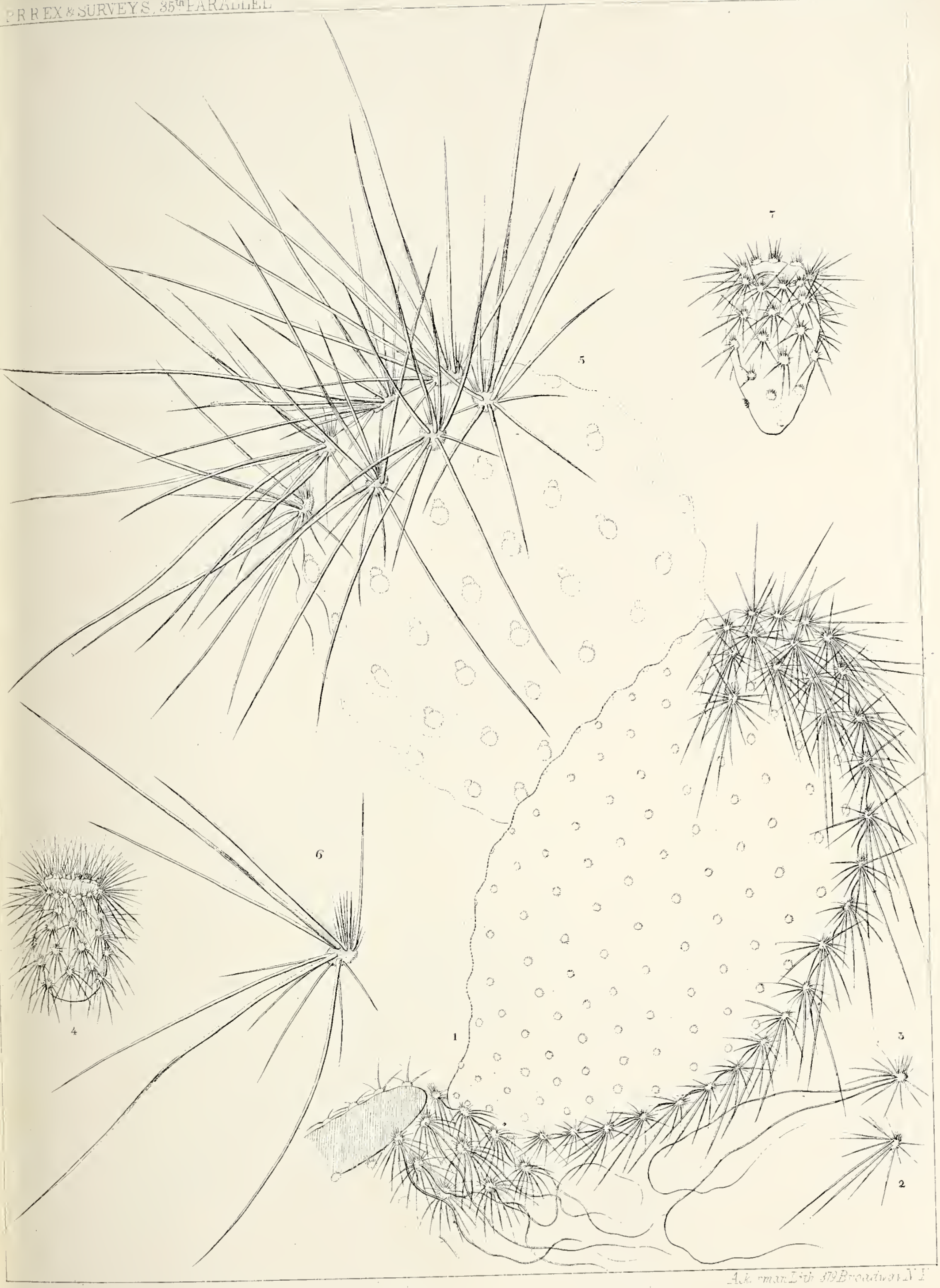
Ackermann Lith. 87 Bro... N.Y.

1-5 OPUNTIA BASILARIS E&B. 6-7. OPUNTIA SPHÆROCARPA, E&B
8-11 OPUNTIA ERINACEA, E&B.



OPUNTIA MISSOURIENSIS DC

1-3. var. RUFISPINA. 4. var. PLATYCARPA. 5-7. var. MICROSPERMA. 8-10. var. ALBISPINA.

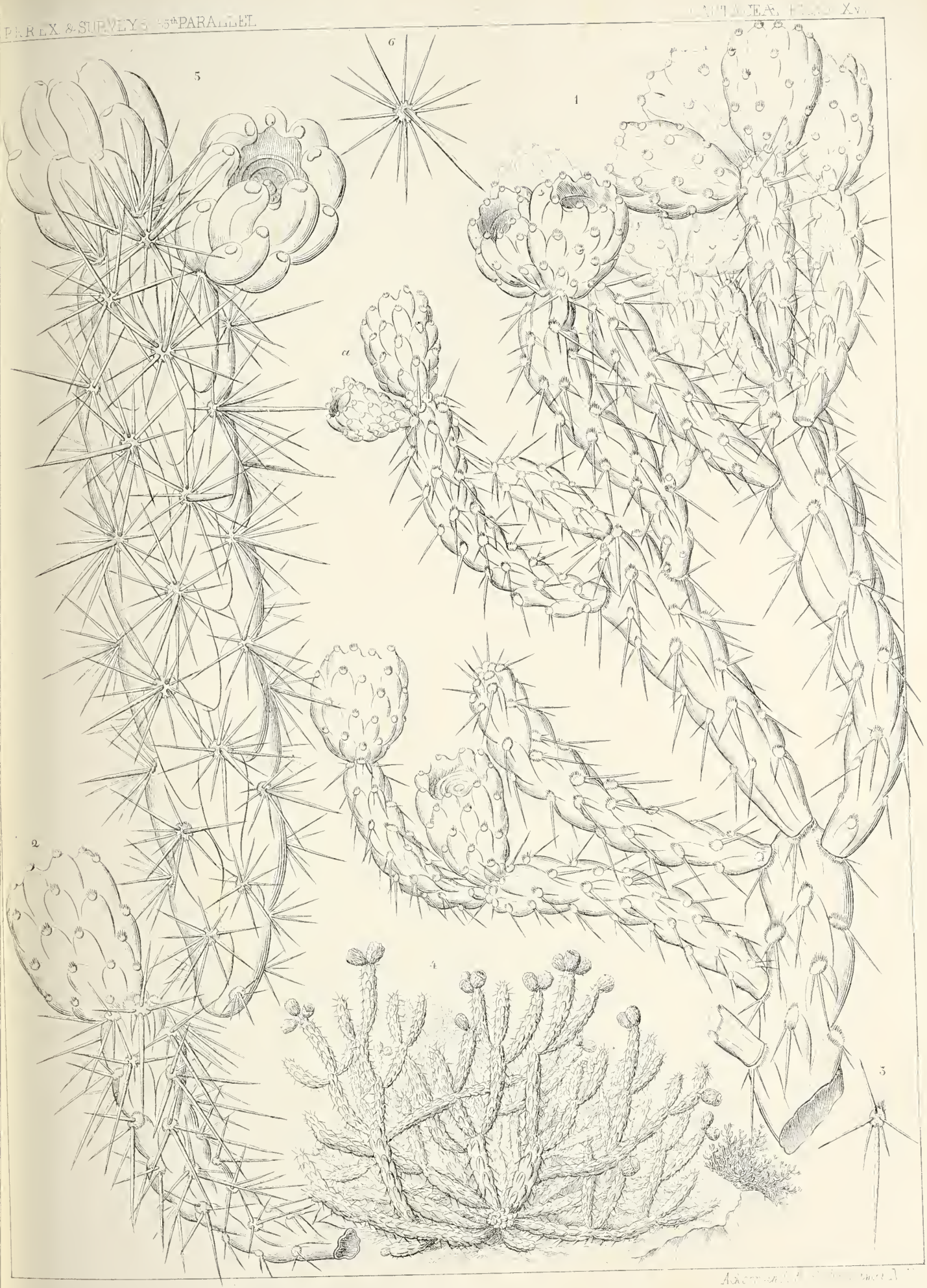


Ackermann Lith. 379 Broadway N.Y.

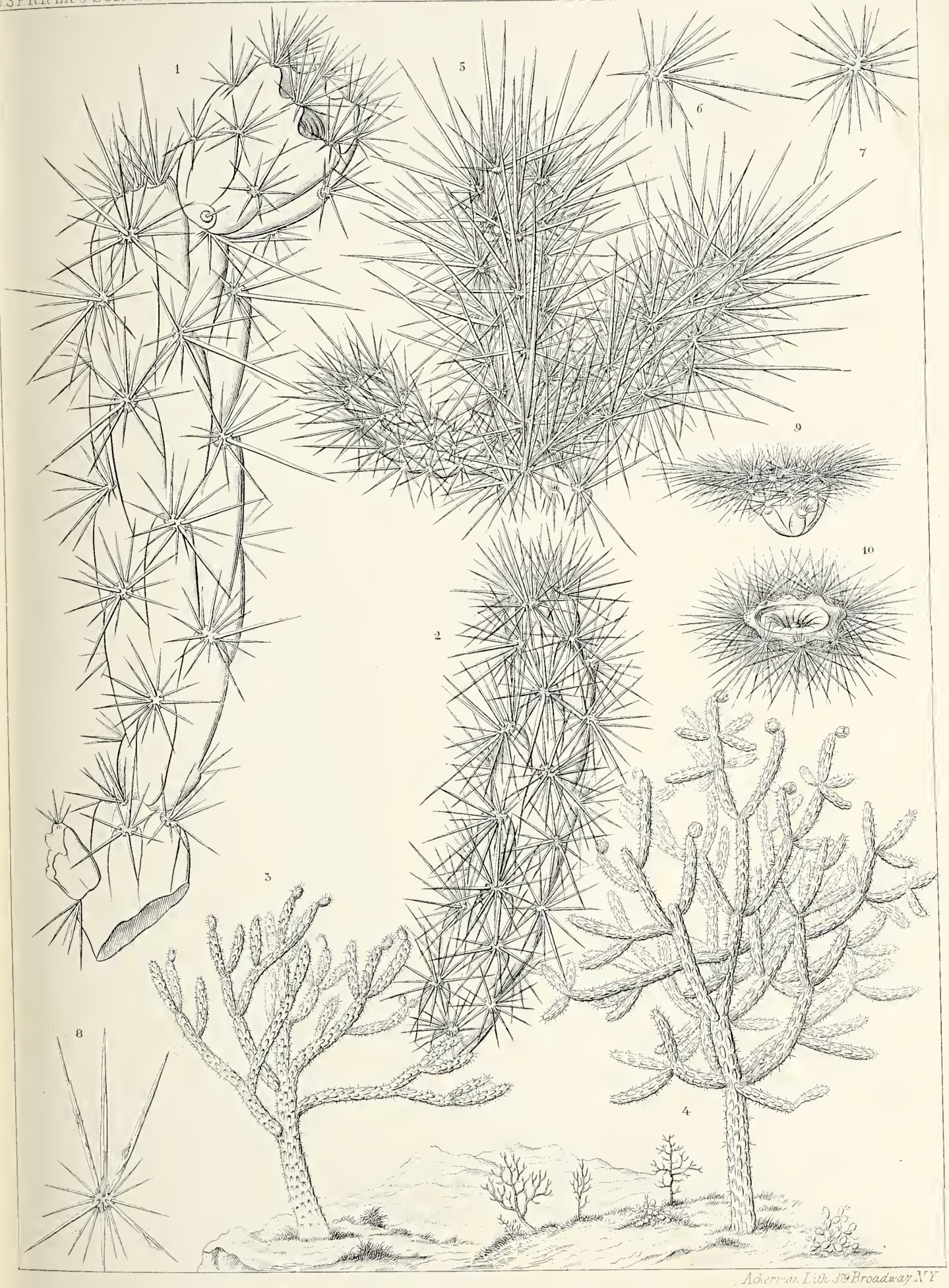
1-4 OPUNTIA MISSOURIENSIS. DC. var TRICHOPHORA. E & B
5-6 OPUNTIA HYSTRICINA E & B.

Ackerman, Lith. 379 Broadway NY

OPUNTIA DAVISII E & B.

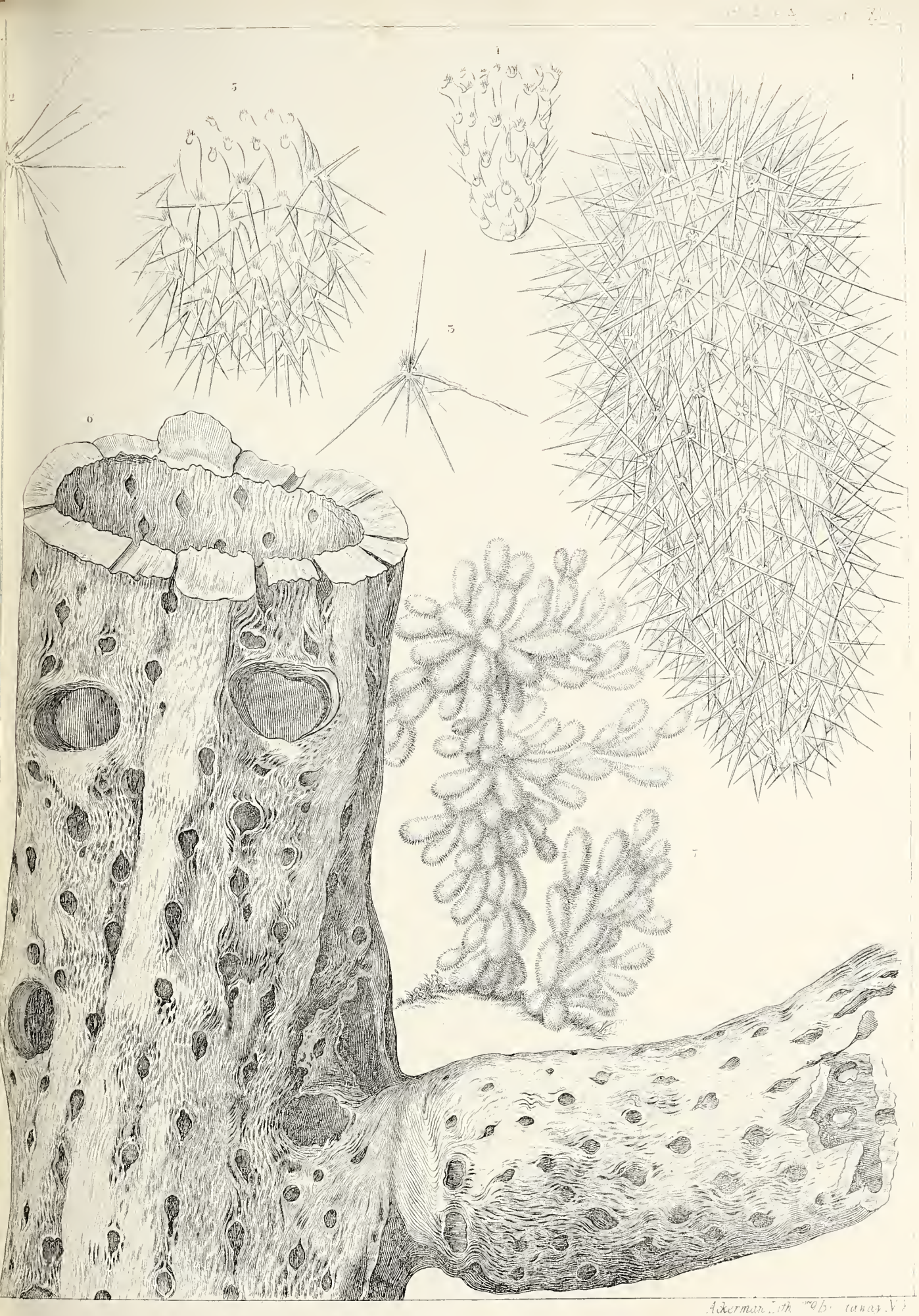


1-4 OPUNTIA WHIPPLEI, E&B 5-6 OP. ARBORESCENS.



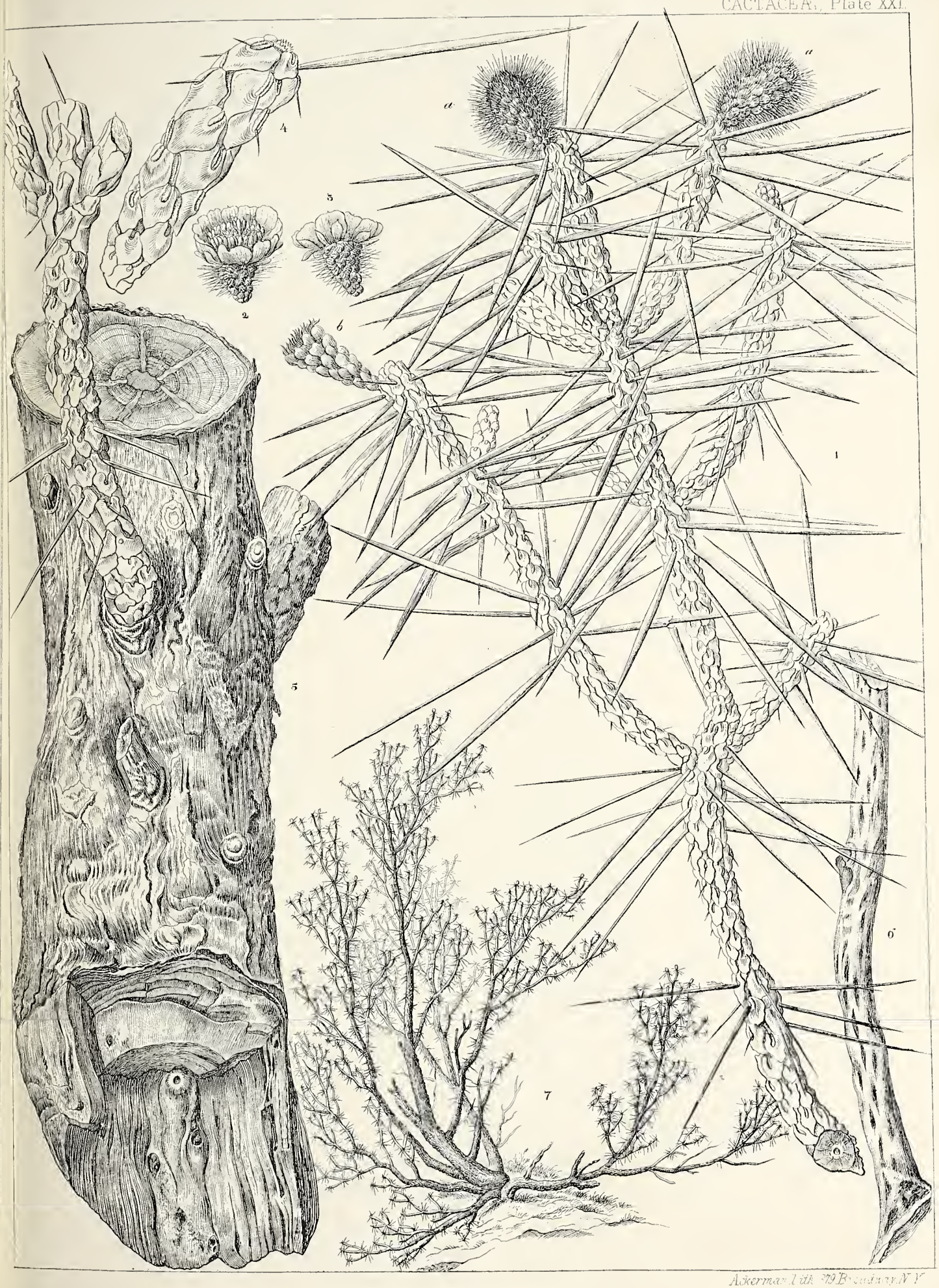
Ackerman Lith. 379 Broadway N.Y.

1-3 OPUNTIA ACANTHOCARPA, E.&B. 4, OP. ARBORESCENS, E. 5-10 OP. ECHINOCARPA, E. & B.



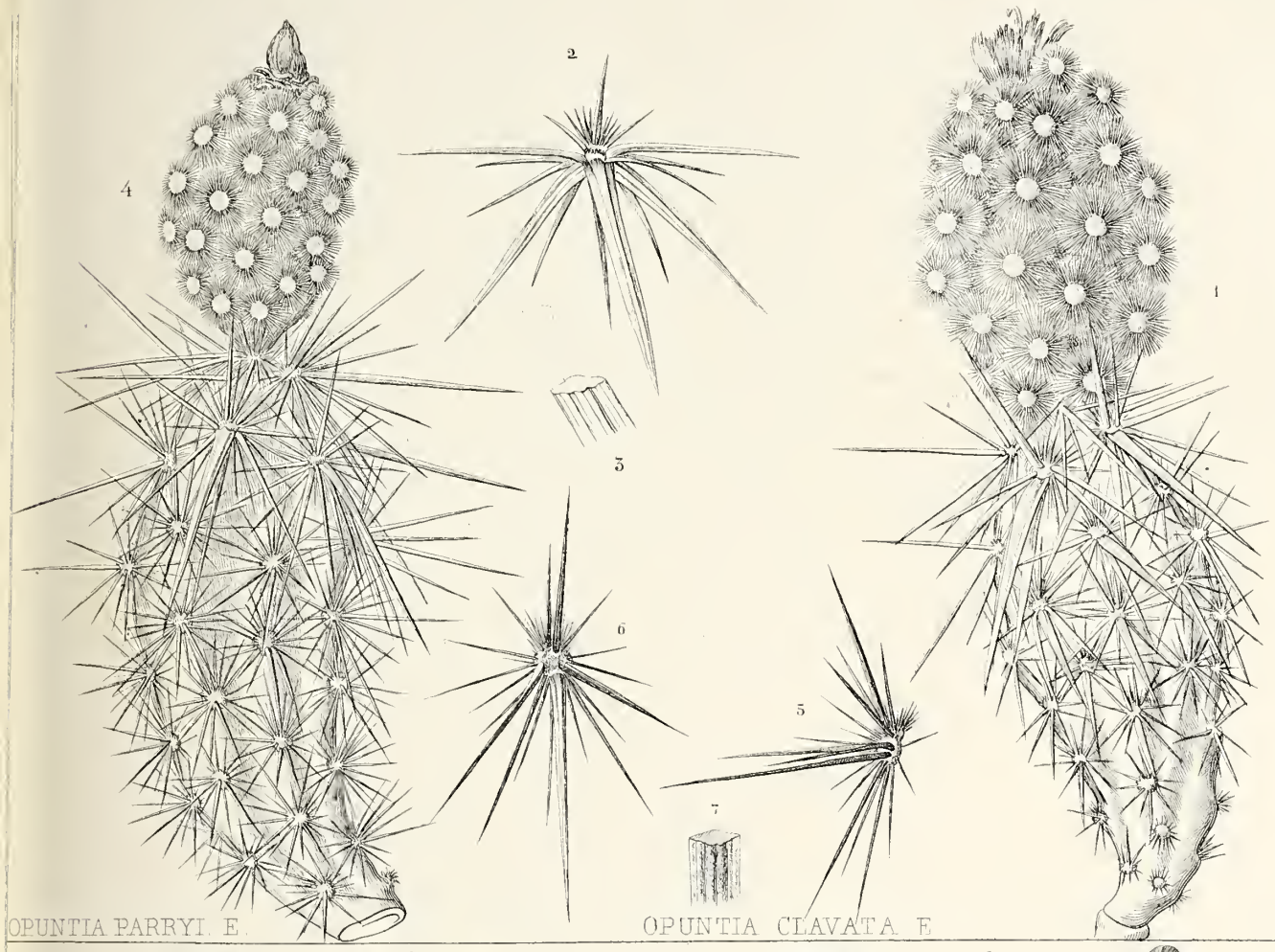
OPUNTIA BIGELOVII. E

1 OPUNTIA VAGINATA, E 2-5 OPUNTIA FRUTESCENS E
1-3 var LONGISPINA 4-5 var BREVISPINA



Ackermann lith. 379 Broadway N.Y.

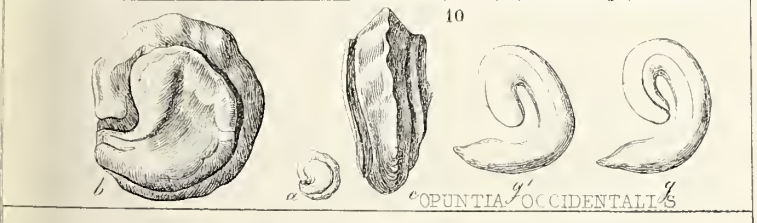
OPUNTIA TESSELLATA, E.



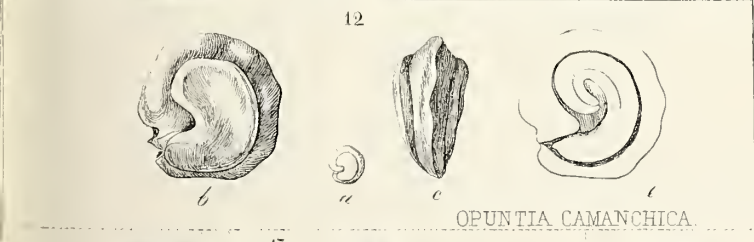
OPUNTIA PARRYI. E

OPUNTIA CLAVATA. E

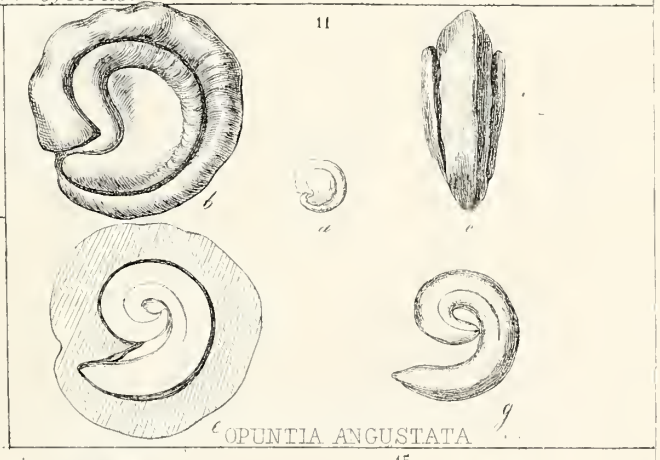
OPUNTIA ENGELMANNI var cyclodes



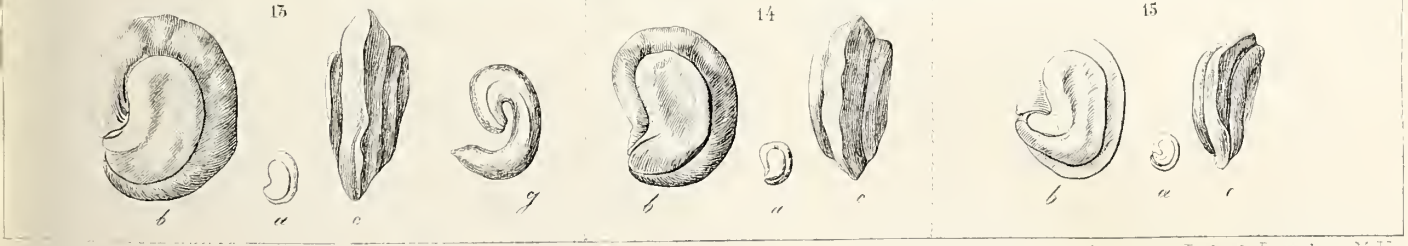
OPUNTIA OCCIDENTALIS



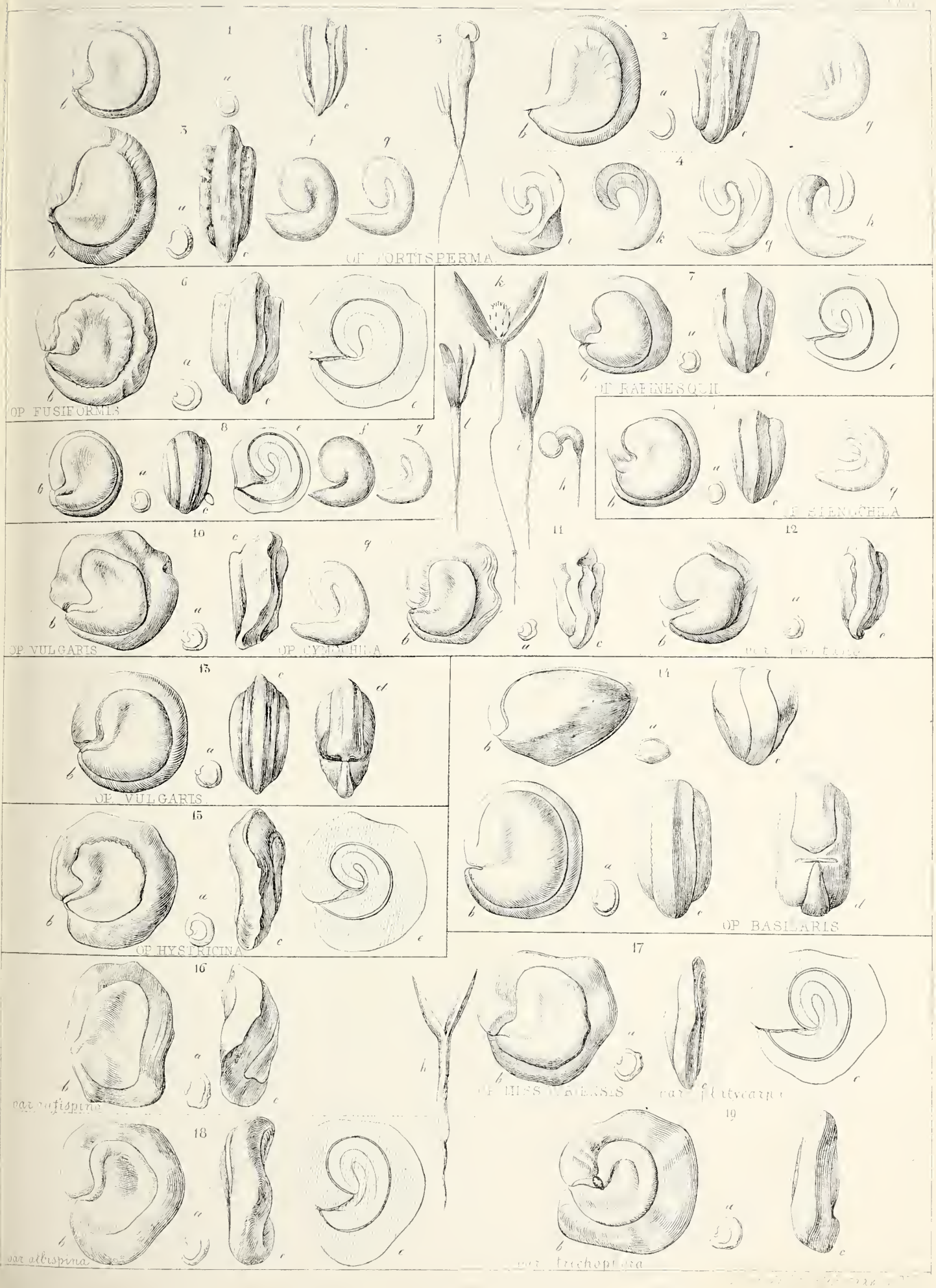
OPUNTIA CAMANCHICA

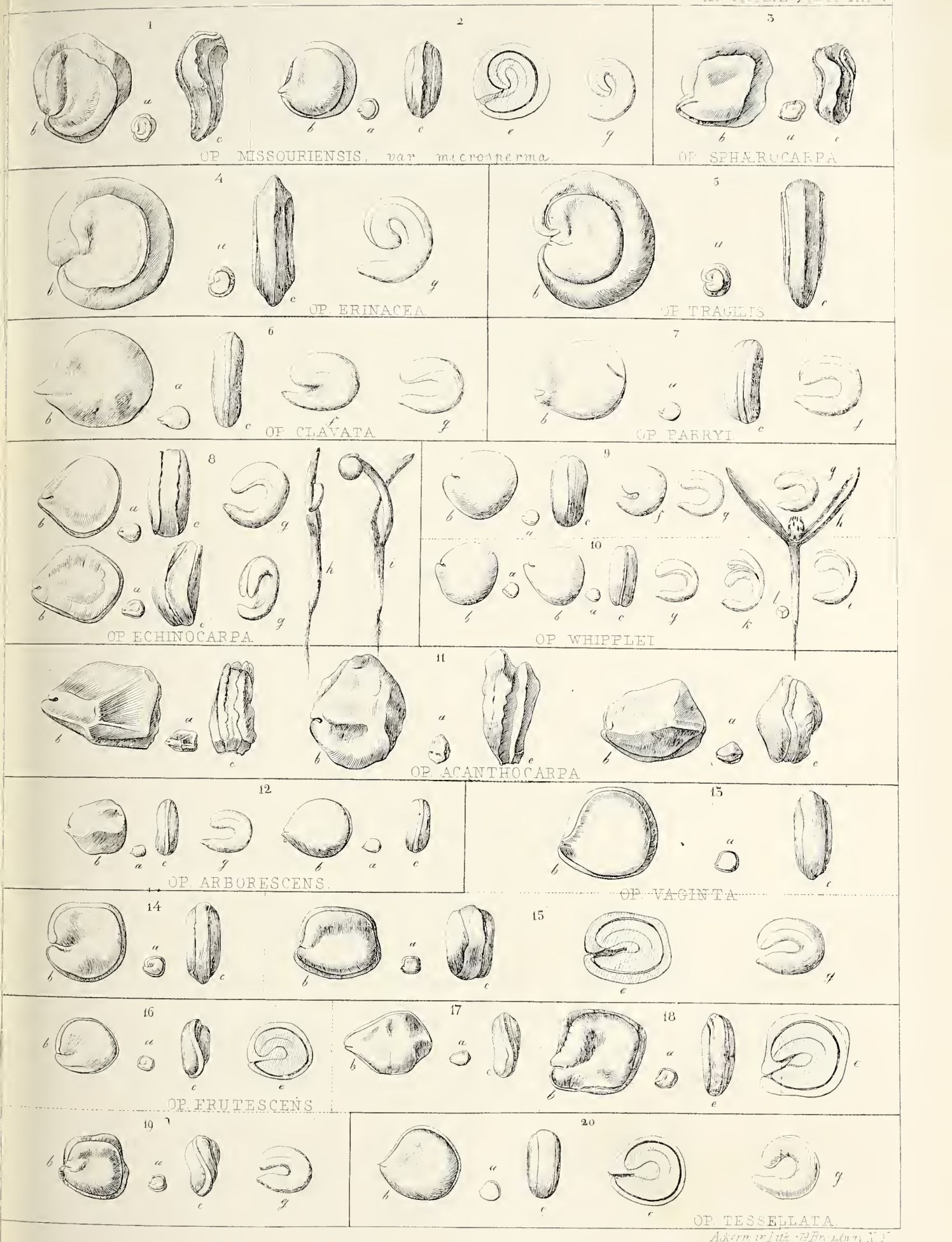


OPUNTIA ANGUSTATA



Acme Photo Litho Co. Brooklyn, N.Y.


OP. FORTISPERMA.
OP. FUSIFORMIS.
OP. RAFINESQUII.
OP. SIENOCHILA.
OP. VULGARIS.
OP. CYMOCHILA.
OP. VULGARIS.
OP. BASILARIS.
OP. HYSTRICINA.
var. retispina.
var. albispina.
var. trichoptera.



Ackermann lith. 79 Broadway N.Y.

INTRODUCTION.

The greater part of the botanical collections made by Dr. J. M. Bigelow, in the Pacific Railroad Survey, under the charge of Captain Whipple, were submitted to me for examination, in accordance with the instructions of the War Department. The plants that were collected before reaching Fort Smith, on the western borders of Arkansas, are of comparatively little interest, and are not included in the following list. The surveying party, in proceeding from Fort Smith to Albuquerque, travelled near the Canadian river, through the Indian territory and northern Texas; thence through northeastern New Mexico to the Rio Grande. This river was crossed on the 10th of November, at which time the flowering season of most plants had passed; and the explorations continued through western New Mexico, chiefly between the parallels of 35° and 36°, to the Great Colorado, which was reached on the 28th of February. The most interesting region of this part of the route is the valley of Williams' river, (commonly called Bill Williams' Fork,) a tributary of the Colorado. Some of the most remarkable plants of the collection were found here, and it is a matter of regret that a country so rich and peculiar in its Flora (and I am informed by Professor Baird that its Fauna is equally remarkable) was not visited at a more favorable season. From the Colorado the route was across the California desert to the Cajon Pass, in the southern part of the Sierra Nevada; thence through Coco Mungo and Los Angeles to San Pedro, on the Pacific coast. Here the surveys of Captain Whipple terminated; but Dr. Bigelow remained in California until near the first of June, and improved the time in exploring considerable portions of the valleys of the Sacramento and San Joaquin, as well as numerous tributaries of those rivers. His ample collections were brought home in perfect order, and the following report affords abundant proof of the zeal and success with which he labored. A number of new genera, and more than sixty new species, have been discovered by Dr. Bigelow, and he has added much valuable information upon many heretofore imperfectly known plants.

The observations of Dr. Bigelow upon the geographical botany of the regions explored are interesting, and are embodied by him in a separate memoir, as also are his notes upon the more interesting forest trees of the country.

The Cactaceæ collected in the Expedition have been elaborated conjointly by Dr. Engelmann and Dr. Bigelow, and are described by them in a separate portion of Captain Whipple's report. The Compositæ and Scrophulariaceæ were described by my friend Dr. Gray, to whom I am indebted also for much valuable aid in drawing up this catalogue, as will be seen by the frequent quotation of his manuscript names in the following pages. The drawings were, with few exceptions, executed by Sprague and Riocreux, two of the most skilful botanical artists now living. All the engraving has been done upon stone by Prestele, who excels in this branch of the art.

JOHN TORREY.

New York, *January* 12, 1857.

No. 4.

DESCRIPTION OF THE GENERAL BOTANICAL COLLECTIONS.

BY JOHN TORREY.

RANUNCULACEÆ.

Clematis ligusticifolia, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 9. Near San Antonita, New Mexico; October. In fruit.

Clematis Bigelovii, (sp. nov.): humilis? herbacea? glabella; foliis pinnatis vel subbipinnatis; foliolis 7–9 trilobis tripartitisve longiuscule petiolulatis, lobis subovatis integerrimis nunc incisis; pedunculis solitariis unifloris; calyce subcampanulato, sepalis anguste oblongis haud crassis apice obtuso patentibus; caudis carpellorum dense plumosus. On the Sandia mountains, New Mexico; October. Of this apparently new Clematis there is only a single flowering specimen and a few mature carpels in the collection. The stem appears to be low and nearly herbaceous, but it probably elongates and climbs by the petioles. The leaflets are only from half an inch to an inch in length, membranaceous and inconspicuously veined; those of the lower pinnæ more divided. Peduncle an inch or two in length, nodding in flower. Sepals scarcely over half an inch in length, pale, membranaceous in the dried state, probably a little thickened in the living plant, but not leathery as in C. Viorna, C. Pitcheri, etc., almost glabrous, except the densely tomentose margin, not appendaged, but the obtuse tip spreading. Carpels silky pubescent, becoming glabrate; the tails over an inch long, plumose as in C. Viorna. The flowers are smaller than in any other North American species of this division.

Clematis lasiantha. *Nutt. in Torr. & Gray, Fl.* 1, *p.* 9. Hill sides, Napa valley, April 27. Only the male plant of this showy species was collected by Dr. Bigelow. The female was not known when the Flora of North America was published; but it has since been found by Colonel Frémont. The carpels have tails of about an inch and a half in length.

Thalictrum Fendleri, *Engelm. in Gray, Pl. Fendl. p.* 5; var.? polycarpum: glaberrimum; carpellis numerosioribus eglandulosis. Mountain ravines, New Mexico. In fruit October, &c. Sides of rivulets, Napa valley, California, April 25, (with immature fruit). It occurs in Coulter's California collection, in flower only. Leaves mostly petiolate, ternately decompound: leaflets obovate and cuneate, incisely 3-lobed; the lobes cut or entire. Panicle contracted, few-flowered. Sepals ovate, rather acute. Carpels 15–25, ovate, compressed, with two prominent ribs on each side. Stigma linear, elongated. T. Fendleri has a more compound and spreading panicle than our plant, and the carpels are more or less glandular.

Thalictrum dioicum, *Linn.; Torr. & Gray, Fl.* 1, *p.* 38. Mountains near San Gabriel; March 23. Only the male flowers are in the collection; and it is possible the plant may be distinct from T. dioicum. That species occurs in Oregon.

Anemone nemorosa, *Linn.;* var. caule gracili elongato; foliis utrinque pubescentibus. San

Geronimo Ranch; April 12. Differs from the ordinary form of A. nemorosa, in its tall stem (which is a foot or more below the involucre), the elongated petioles, and the pretty strong pubescence of the leaves. The leaflets are rhombic-ovate, incised and rather coarsely toothed, but the lateral ones are not two-parted in any of the specimens. Such leaflets, however, occur now and then in the eastern A. nemorosa. Rev. Mr. Spalding found the same plant on the Kooskooskee, in Oregon, and it exists in Geyer's collection.

Ranunculus aquatilis, *Linn. sp. p.* 556. Corte Madera; in water; April 10–13. This seems not to be the form or species which almost universally represents the section Batrachium in North America, but what is called R. aquatilis by those European authors, who do not subdivide the Linnæan species extremely. It is a state destitute of emersed leaves.

Ranunculus hederaceus, *Linn.* var. With the preceding. Nearly the R. tripartitus, *D.C.*, as to the leaves, etc.; but the receptacle of the fruit is glabrous. The petals are oblong-obovate and twice the length of the calyx. This is the first Batrachium, bearing emersed leaves, which we have received from any part of North America.

Ranunculus trachyspermus, var.? Lindheimeri, *Engelm. in Pl. Lindh.* 1, *p.* 3. Napa valley, in wet places; April 26. The granulate roughened carpels principally distinguish this from R. pusillus (to which R. oblongifolius, *Ell.*, with large bright yellow petals, numerous stamens, and apiculate achenia, does not properly belong). The heads of carpels incline to become oblong.

Ranunculus divaricatus, *Schrank; Gray, Pl. Wright.* 2, *p.* 8. In the bed of the Pecos; October.

Ranunculus affinis, *R. Br.; Var. β. Hook. Fl. Bor.-Am.* 1, *p.* 13, *t.* 6. Near San Antonita; October. In fruit.

Ranunculus Californicus, *Benth. Pl. Hartw. p.* 295. R. dissectus, *Hook. & Arn. Bot. Beech. p.* 316. R. delphinifolius, *Torr. & Gray, Fl. Suppl. p.* 659, *non H. B. & K.* Los Angeles; March 21. This is R. acris *β. Torr. & Gray* = R. Deppii, *Nutt. Mss.* It agrees exactly with Nuttall's specimens. Two forms of the plant were collected by Dr. Bigelow. 1. About a span high, manifestly pubescent, and the leaves with narrowly linear segments. 2. Tall and stout; less pubescent; leaves with oblong-cuneate segments. Fremont gathered the latter in 1846, near San José.

Ranunculus repens, *Linn.; Torr. & Gray, Fl. l. c.* San Francisco; April 5. Resembles the European. In the long styles it agrees with some of the forms of this polymorphous species, though not with the ordinary state of it, that we find in the northern States.

Ranunculus canus, *Benth. Pl. Hartw. p.* 295. Hill sides, Duffield's Ranch, Sierra Nevada; May 11. A less white-hairy form; some of the radical leaves only 3–5-parted. The plant is probably only a state of R. repens.

Ranunculus hebecarpus, *Hook. & Arn. Bot. Beechey, p.* 369. R. parviflorus, *Torr. & Gray, Fl.* 1, *p.* 25. Along rivulets, Sonora, May 9th; and hill-sides, Knight's Ferry, Stanislaus; May 8. Not an uncommon species in the southern part of California. It is regarded by most of our botanists as a variety of R. parviflorus, which, indeed, it very much resembles. This species differs, however, it being much less hairy; the lobes of the leaves are broader and less acute; the fruit is decidedly tuberculate, while in R. hebecarpus it is merely a little roughened, and the pubescence longer. In the latter the beak of the fruit is decidedly shorter than in the former.

Aquilegia Canadensis, *Linn.; Torr. & Gray, Fl.* 1, *p.* 29; var. sepalis limbo petalorum duplo-longiorius, calcare subæqualibus. A formosa, *Fisch. in DC. Prodr.* 1, *p.* 20; *Torr. & Gray, l. c.* Plains near Oakland, California; April 5.

Delphinium nudicaule, *Torr. & Gray, Fl.* 1, *p.* 33, & 661. D. sarcophyllum, *Hook. & Arn. Bot. Beechey, p.* 317. Hill sides, Napa valley, April 27, and near San Geronimo Ranch, California, April 12. A beautiful species with large scarlet flowers. It would be a great acquisition to our gardens.

A splendid scarlet-flowered Delphinium was discovered by Dr. Parry, in 1850, on the mountains east of San Diego. It is D. coccinium, *Torr.* (Bot. Mexican Boundary Survey, with a

figure). It differs from D. nudicaule in the leaves, the lobes of which are deeply 3-cleft, with linear-lanceolate acute segments.

Delphinium azureum, *Michx. Fl.* 1, *p.* 314: var. floribus cœruleo-albidis, *Benth. Pl. Hartw. p.* 296. Plains, etc., Knight's Ferry, Stanislaus; May 7.

Delphinium patens, *Benth. Pl. Hartw., p.* 296. Hills, Napa; and on mountains near Oakland; April 4–25.

Delphinium simplex, *Dougl. in Hook. Fl. Bor.–Amer.* 1, *p.* 25; *Hook. & Arn. Bot. Beechey, p.* 317. Napa valley; April 26.

Delphinium variegatum, *Torr. & Gray, Fl.* 1, *p.* 32; D. decorum, *Benth. Pl. Hartw. p.* 295. Napa valley; April 26. Flowers sometimes almost white.

Delphinium decorum, *Fisch. & Mey. Index sem.* (3) *Petrop., p.* 33. Plains near Punta de los Reyes; April 17. Perhaps D. variegatum is not distinct from this.

Delphinium scopulorum, *Gray, Pl. Wright.* 2, *p.* 9. In the Sandia mountains, New Mexico; October. In fruit.

Actæa spicata, *Linn.* var. arguta, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 35. Redwoods, Corte Madera, and Oakland; April 4–10. Not found before south of Oregon. We are of opinion that A. rubra and A. alba are likewise only varieties of A. spicata.

Pæonia Brownii, *Dougl. in Hook. Fl. Bor.–Amer.* 1, *p.* 27; *Bot. Reg.* 25, *t.* 30. Cocomungo, March 17; and Duffield's ranch, Sierra Nevada, May 10. P. Californica, *Nutt.*, is not a distinct species.

Crossosoma Californica, (Tab. I,) *Nutt. Pl. Gamb. in Journ. Acad. Philad.* (*ser.* 2) 1, *p.* 150. Cañons on Williams' River, a branch of the Colorado, western New Mexico; February 8. In the memoir above quoted, Mr. Nuttall does not express any opinion as to the affinities of this genus, owing to the embryo being unknown, the seeds in all his specimens being imperfect; but he says that it "may well form a Suborder Crossosomeæ." On the ticket of a fragment of this plant, which he sent us, he has written: Nat. Order Pæoniaceæ. Unfortunately, our specimens are only in flower, and the ripe seeds are still wanting. Although the stamens are decidedly perigynous, and the seeds are furnished with an ample fimbrillate arillus, the plant may nevertheless belong to the tribe or Suborder Pæoniaceæ. We were once inclined to refer it to tribe Spirææ of Rosaceæ, to which it has some resemblance in the flowers; but it is destitute of stipules, and arillate seeds are not found in that order. We should place this remarkable plant in Dilleniaceæ, were it not for the perigynous stamens. These are inserted in several series into the upper part of a thin disk which, lining the tube of the calyx, projects in a somewhat tumid border around the base of the pistils, as in Pæonia.

BERBERIDACEÆ.

Vancouveria hexandra, *Morr. & Dec. in Ann. Sc. Nat.* (2 *ser.*) 2, *p.* 351; *Torr. & Gray, Fl.* 1, *p.* 52. Epimedium hexandrum, *Hook. Fl. Bor.–Am.* 1, *p.* 31, *t.* 13. Deep ravines and shady woods, Napa valley; April 27.

Berberis Aquifolium, *Pursh, Fl.* 1, *p.* 219, *t.* 4, (*excl. fig.* 4.) Hill-sides Downieville, Yuba; May 22. In the specimens from this locality, the leaflets are mostly reduced to a single pair, and are sometimes even solitary. The Var. repens was found in the Sandia mountains of New Mexico.

Berberis pinnata, *Lag. Elench.* 1803, *p.* 6; *Benth. Pl. Hartw., p.* 296. Mahonia fascicularis, *DC. Syst.* 2, *p.* 19, *and in Deless. Ic.* 2, *t.* 3. Mountains near Oakland; April 4. This agrees pretty well with Delessert's figure, but we are not confident that it is distinct from B. aquifolium. The short petioles are pretty constant, but we can find no other reliable characters. This plant occurs also near San Francisco.

Berberis trifoliata, *Moricand, Pl. Amer. t.* 69? In arroyas and cañons; Lithodendron creek western New Mexico; December 4, (in fruit.) This species grows 15 feet high. The leaves

have frequently two pairs of leaflets, which are furnished with 2–4 (sometimes more) very strong angular teeth. The fructiferous racemes are loose, and the pedicles of the dark-blue berries are half an inch long. The same plant grows between the Rio Grande and the Gila, where it was collected by Major Emory, and it is the B. pinnata of Sitgreave's report. Colonel Frémont found it on the tributaries of the Virgin river. Dr. Gregg collected, near the battle-field of Buena Vista, what seems to be the same species, except that he says the berries are reddish; but they may be so only when they are unripe.

Berberis Fendleri, *Gray, Fl. Fendl., p.* 5. Mountain arroyas and bluffs on the Pecos, New Mexico; October. In fruit. The lower cauline leaves are spinulose-toothed, and the racemes appear not to have been many-flowered; otherwise the specimens accord with those of Fendler.

PAPAVERACEÆ.

Eschscholtzia Californica, *Cham.; Torr. & Gray, Fl.* 1, *p.* 664. Sandy plains, Cocomungo; March 19. Common in most parts of California.

Eschscholtzia Douglasii, *Hook. & Arn. Bot. Beech., p.* 320; *Torr. & Gray, l. c.*—Hill-sides Knight's ferry, Stanislaus; May 8. We find the acumination of the calyx nearly as long as in the preceding species. The flowers, too, are smaller than in the Oregon plant.

Eschscholtzia Douglasii, Var. *tenuifolia.* E. tenuifolia, *Benth. in Trans. Hort. Soc.* (*ser.* 2) 1, *p.* 408. With E. Douglasii, from which it differs only in its usually very short stem, long sub-radical peduncles, and very narrow segments of the leaves; characters which are by no means constant. What appears to be a diminutive form of this variety, was collected on Williams' River of the Great Colorado, early in February.

Dendromecon rigidum, *Benth. in Hort. Trans.* (*ser.* 2) 1, *p.* 407; *Hook. Ic. t.* 37. Gravelly hills near Oakland, California; April 5.

Meconella Californica, *Torr. & Frém. in Frém. 2d Rep.* Mokelumne hill, California; May 17. Also found on the American river by Mr. Rich, and near San Francisco by Mr. Thurber. We have also specimens collected in California by Mr. Gibbes. It differs from M. Oregana in having 11 or 12 stamens, and in its much larger flowers.

Platystigma lineare, *Benth. in Hort. Trans.* (2 *ser.*) 1, *p,* 407; *Hook. Ic. t.* 38; *Torr. & Gray, Fl.* 1, *p.* 65. Low places near San Francisco; April 8. A much rarer plant than the next.

Platystemon Californicum, *Benth. l. c.; Lindl. Bot. Reg. t.* 1679; *Torr. & Gray, Fl. l. c.* Cocomungo, March 17; plains near San Gabriel, March 23. *β* leiocarpum, *Torr. & Gray, l. c.* Hills and plains, Benicia, April 24; Knight's ferry, Stanislaus, May 8.

Meconopsis heterophylla, *Benth. l. c.; Torr. & Gray, Fl.* 1, *p.* 61; *Hook. Ic.* 8, *t.* 732. Hill-sides, Martinez, California; April 23.

Argemone Mexicana, *Linn.* Plains of Deer creek, Arkansas; August.

FUMARIACEÆ.

Dicentra formosa, *DC. Syst.* 2, *p.* 109; *Torr. & Gray, Fl.* 1, *p.* 603, (not 67.) Fumaria formosa, *Dryand. Bot. Mag. t.* 1335. Mountains near Oakland, April 5; hillsides and ravines, Duffield's ranch, Sierra Nevada, May 12.

CRUCIFERÆ.

Cheiranthus capitatus, *Dougl. in Hook, Fl. Bor.-Amer.* 1, *p.* 38; *Torr. & Gray, Fl.* 1, *p.* 71. C. asper, *Cham. & Schlecht. in Linnæa* 1, *p.* 14, (excl. syn.) Erysimum grandiflorum, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 96. Sand Hills, near the sea-shore, Punta de los Reyes, April 17. A true Cheiranthus.

Nasturtium palustre, DC.: the usual short-fruited form. On the Pecos, and St. Domingo; October.

NASTURTIUM OBTUSUM, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 74. River banks, Middle Yuba, May 2. The North American species of this genus need a careful revision. Thei are probably too many of them described in our books.

NASTURTIUM CURVISILIQUA, *Nutt. l. c.* Gravelly hills near the Colorado; Feb uary. Without full-grown fruit.

BARBAREA VULGARIS, *R. Br.*; var. pedicellis angulo recto patulis, etc. *Benth. Fl. Hartw.*, *p.* 297. Near San Francisco and Punta de los Reyes, April.

STREPTANTHUS FLAVESCENS, *Hook. Ic.* 1, *t.* 34; *Torr. & Gray, Fl.* 1, *p.* 77. River banks, Benicia, April 24. Sepals hairy. Pods about an inch and a half long, nearly terete, sparsely hirsute, with a long tapering point, strictly erect. Pedicles almost hispid, with spreading or reflexed hairs.

STREPANTHUS LINEARIFOLIUS, *Gray, Pl. Fendl.*, *p.* 7. Gravelly and rocky places, on Hurrah creek; September. The radical and some of the lower cauline leaves are spatulate or obovate, and short.

STREPANTHUS CORDATUS, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 77. River banks, Middle Yuba, May 21. Stem 2–3 feet high, paniculately branched above; whole plant very smooth and somewhat glaucous. Lower leaves and sometimes the cauline ones repandly or sharply denticulate; the latter about an inch long, mostly obtuse, strongly clasping. Pedicles usually almost as long as the flower, spreading and curved upward. Flower buds acute. Calyx very obtuse at the base. Sepals with a long narrow acuminate point, the exterior ones carinate, petals spatulate, shorter than the calyx. Torus or receptacle dilated. Pods not seen. We have specimens of the plant collected in California by Colonel Frémont and Mr. Gibbes.

STREPANTHUS LONGIFOLIUS, *Benth. Pl. Hartw.*, *p.* 10, *No.* 52. *Gray, Pl. Fendl.*, *p.* 6, var. glaber; pedicellis brevioribus. Sandy hills near the Colorado of the West. New Mexico, February 22. Root annual. Stem about a foot high, slender. Lower leaves acutely repand-dentate; upper ones linear-oblong, entire. Pedicles shorter than the closed calyx, recurved after flowering. Petals linear-spatulate, pale purple, a little exserted. Pods (immature) an inch long, with a tapering summit.

TURRITIS GLABRA, *Linn.; Torr. & Gray, Fl.* 1, *p.* 78. T. macrocarpa, *Nutt. in Torr. & Gray, Fl. l. c.* Near San Francisco, April 3. A dwarf state of this species was found on Cajon creek, March 17. We reduce Nuttall's T. macrocarpa to T. glabra, as there are often intermediate forms between the two.

TURRITIS PATULA, *Graham, in Edinb. Phil. Jour.*, (1829,) *p.* 7; *Torr. & Gray, Fl.* 1, *p.* 79 *Gray, Pl. Wright.* 2, *p.* 10. Yuba river, May 22. In all Dr. Bigelow's specimens of this plant the stem-leaves are nearly as hairy as the radical leaves.

TURRITIS PATULA, *Graham; Hook. Fl. Bor.,–Am.* 1, *p.* 40: var. magis hispidula. Hill sides, Downieville; May 22.

ARABIS HIRSUTA, *Scop.; Torr. & Gray, Fl.* 1, *p.* 80. *β.* GLABRATA, *Torr. & Gray, l. c.* Wet ravines, Duffield's ranch, Sierra Nevada, May 11, (in flower.)

CARDAMINE ANGULATA, *Hook. Bot. Misc.* 1, *p.* 343, *t.* 69; *Torr. & Gray, Fl.* 1, *p.* 84. C. paucisecta, *Benth. Fl. Hartw.*, *p.* 297. Hill-sides, Duffield's ranch, Sierra Nevada, May 10; mountains near Oakland, April 4; and plains near San Gabriel, March 23. Radical leaves sometimes entire; but more commonly 3-parted, with the segments petiolulate, roundish, entire, or obscurely repand-toothed; stem-leaves 3–5-parted; the segments varying in form from broadly ovate and cordate to lanceolate, and narrowed at the base, entire, toothed. Flowers as large as in Cardamine rhomboidea. Pods erect, an inch and a half long, on a stalk of about the same length, $1\frac{1}{2}$ line wide, tapering to a long point. Seeds narrowly margined, distant. Root tuberiferous.

CARDAMINE OLIGOSPERMA, *Nutt. in Torr. & Gray, Pl.* 1, *p.* 85; *Benth. Fl. Hartw.* Near San Francisco; April 3. Very near C. hirsuta, but differs in the broader pods and less numerous seeds.

Sisymbrium officinale, *Scop.; Torr. & Gray, Fl.* 1, *p.* 91. Near Benicia, April 24. Doubtless introduced.

Sisymbrium canescens, *Nutt. Gen.* 2, *p.* 68; *Torr. & Gray, Fl.* 1, *p.* 92. Var. Californicum, *Torr. & Gray, l. c.* Williams' River of the Colorado, New Mexico. February 6–18.

Sisymbrium deflexum, (*Harvey, Mss. in herb. Gray:*) annuum, pilis patentibus hispidulum; caule stricto, folioso simplici, foliis oblongis inferioribus pinnatifidis seu pinnatipartitis, segmentis lineari-lanceolatis distantibus laciniato-dentatis integrisve, sinubus obtusis; foliis supremis linearibus integris; pedicellis brevibus cum siliquiis angustissimis rectis elongatis teretiusculis arcte deflexis. Turritis? lasiophylla, *Hook. & Arn. Bot. Beechey, p.* 321? Hill-sides, Napa valley, April 26. About three feet high, slender, the lower half almost hispid, with short spreading hairs. Lower leaves petiolate, 2–3 inches long, more hispid than the stem; middle leaves sharply toothed; the highest 2–3 lines wide, and usually entire. Flowers about as large as in Cardamine hirsuta, and apparently white. Petals oblong-spatulate. Pods 2–3 inches long, and scarcely half a line wide. Pedicles 2 lines long. Cotyledons incumbent. This plant resembles a Sisymbrium from Coulter's Californian collection, sent to us by Dr. Harvey under the name of S. deflexum *Harv.*, of which we believe no description has yet appeared. A smoother and more humble form of it (some of the specimens only 2 or 3 inches high) was collected near San Francisco, April 3.

Sisymbrium incisum, *Engelm. in Pl. Fendl., p.* 8. Mountain arroyas, near San Antonita, New Mexico; October.

Erysimum asperum, *DC.* Laguna Blanca to the Sandia mountains.

Thelypodium Wrightii, *Gray, Pl. Wright.* 1, *p.* 7. Rocky places on the Pecos; September. Many of the flowers are in an enlarged and abnormal state, probably from the stinging of insects.

Tropidocarpum gracile, *Hook. Ic.* 1, *t.* 43; *Torr. & Gray, Fl.* 1, *p.* 94. T. scabriusculum, *Hook. l. c.; Torr. & Gray, l. c.* Plains near San Gabriel, March 23. We find the two species of Hooker to pass into each other.

Erysimum asperum, *DC. Syst.* 2, *p.* 506; *Torr. & Gray, Fl.* 1, *p.* 94 Near San Francisco, April 3, and mouth of Santa Rosa creek, May 1, (with flowers and immature fruit.) Flowers cream-color or pale yellow, becoming deeper in drying. A variety (or possibly distinct species) with much larger and orange-yellow flowers, was found at Cocomungo, March 17, without fruit; also found by Mr. Wallace. We are unable to find characters that will clearly distinguish E. Arkansanum and E. elatum from this species. The leaves and degree of pubescence are very variable, and the pods seem to be the same in all of them.

Vesicaria argyrea, *Gray, Pl. Lindheim.* 2, *p.* 147. Arroyas and cañons, Williams' River of the Colorado, New Mexico, February 7–26.

Vesicaria Fendleri, *Gray, Pl. Fendl., p.* 9. Bluffs and rocky places, New Mexico; October. To this very polymorphus species must be referred V. stenophylla, *Gray, Pl. Lindh.* 2, *p.* 149.

Draba aurea, *Vahl; Hook. Bot. Mag. t.* 2934. San Antonita, New Mexico, and in the Sandia mountains, in rocky places; October. Mostly in fruit. From these specimens the plant appears to have a biennial root, while those of Fendler would seem to be perennial. The silicles are mostly twisted.

Draba cuneifolia, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 108. Williams' River of the Colorado; February 11.

Dithyrea Wislizeni, *Engelm. in Wisl. Mem. New Mex., p.* 11; *Torr. in Marcy, Expl. Red River, t.* 11. On prairies and sandy bottoms of the Canadian, near Antelope Hills; September. It is from this region doubtless that the plant was first collected by Dr. James.

Dithyrea Californica, *Harv. in Hook. Lond. Jour. Bot.* 4, *p.* 77, *t.* 5; *Engelm. in Wisliz. Mex. p.* 95. Sandy hills on the Colorado of the West. February 22. The radical leaves are deeply lyrate-pinnatifid. The calyx is 4 or 5 lines long; much longer, narrower, and more closed than that of D. Wislizeni. The petals appear to have been purple.

Lepidium nitidum, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 116. Sandy plains, Cocomungo; March

17. A humble annual; seldom more than a span high. The flowers are tetrapetalous in all of Dr. Bigelow's specimens.

Lepidium alyssoides, *Gray, Pl. Fendl. p.* 10. San Antonita and Galisteo, New Mexico; October.

Lepidium Wrightii, *Gray, Pl. Wright.* 2, *p.* 15. On Williams' River of the Colorado, New Mexico; February 11. There are 4 minute petals in all the specimens.

Lepidium flavum (sp. nov.): annuum, pusillum, acaule, demum prolifero-ramosum, depressum glabrum; foliis crassiusculis oblongo-spathulatis pinnatifidis, lobis rotundatis brevibus; floribus capitato-congestis flavis; petalis obovatis unguiculatis; siliculis ovatis, sinu lato emarginato truncatis breviter bidentatis stylo bis longioribus. Sandy places near the Mohave creek; March 13. These are early specimens of a minute depressed plant, in flower only. But a single specimen was gathered by Fremont, in the same region, in his second expedition, from which the fruit is here characterized. The leaves are half an inch or more in length, and mostly rosulate around the sessile capitate or umbellate cluster of small *yellow* flowers: and the axis of the inflorescence apparently does not elongate in fruit. Stamens tetradynamous. Silicle a line long. Valves minutely reticulated. Cotyledons incumbent.

Thysanocarpus elegans, *Fisch. & Mey. Ind. Sem. St. Petersb., Dec.* 1835; *Torr. & Gray, Fl.* 1. *p.* 118. Hill sides, Napa; April. The pods are perforated only when they are quite mature and dry. They vary in shape from nearly orbicular to orbicular-obovate. The stem is usually simple or with very few branches. T. pulchellus, *Fish. & Mey.*, and T. radians, *Benth.*, seem to be only forms of this species.

Thysanocarpus crenatus, *Nutt. in Torr. & Gray, Fl. l. c.* Hill sides, Sonora, California; May 9. Chiefly distinguished from T. elegans by its smaller pods and paniculately branching stem.

Thysanocarpus laciniatus, *Nutt. in Torr. & Gray, Fl. l. c.* Plains near San Gabriel, March 23, and sandy places, Cajon creek. Radical leaves pinnatifid; the segments very narrow and entire.

Thysanocarpus oblongifolius, *Nutt. in Torr. & Gray, Fl. l, c.* Sides of hills, Napa; April 26.

Thysanocarpus pusillus, *Hook. Ic.* 1, *t.* 43; *Torr. & Gray, Fl. l. c.* Low wet places near San Francisco, April 8, and Murphy's, May 14.

CAPPARIDACEÆ.

Cleome (Peritoma) integrifolia, *Torr. &. Gray, Fl.* 1, *p.* 122; *Gray, Gen. Ill. t.* 76, *Pl. Fendl. p.* 11. Comanche plains, on the banks of rivulets; September. The form with lanceolate leaflets, and very densely crowded, large flowers. Galisteo, and on the Rio Grande near Santa Domingo, in low places; October: a form with oblong or obovate leaflets, and smaller as well as fewer flowers, mostly on short axillary branchlets, appearing considerably different, but doubtless of the same species. Fendler's No. 49 is intermediate. The leaflets are entire in all the specimens I have seen. Probably, however, C. serrulata, *Pursh* is not distinct.

Cristatella Jamesii, *Torr. & Gray, Fl.* 1, *p.* 124; *Gray, Gen. Ill. t.* 77. Gravelly hills, on the Canadian; September.

Polanisia uniglandulosa, *DC. Prod.* 1. *p.* 242; *Gray, Pl. Wright.* 1, *p.* 10. P. trachysperma *Torr. & Gray, Fl.* 1, *p.* 669. On the Canadian, and at Anton Chico; August, September.

VIOLACEÆ.

Viola Sheltonii, (sp. nov.): glabra, caulibus adscendentibus brevibus; foliis circumscriptione reniformi-cordatis trisectis, segmentis subsessilibus, irregulariter palmatim 5–8-fidis lobatisve, lobis lineari-cuneatis obtusis; stipulis parvulis ovatis apice ciliatis, sepalis lineari-lanceolatis; petalis luteis, calcare brevi sacciforme, (Tab. II.) Hill sides, Yuba, near Downieville; May 8. A neat little species resembling V. Beckwithii, *Torr. & Gray in Beckwith's Report;* but that has the divisions of the leaves conspicuously petiolulate, and the two upper petals purple.

Viola lobata, *Benth. Pl. Hartw. p.* 298. Moist and shady places, Napa valley, April 27; Grass valley, May 21. Rhizoma short, throwing down a tuft of long thick fibres. Stem sometimes a foot high, naked below. Leaves variable in the lobing. Flowers large, the petals yellow, often tinged with purple, especially on the outside; the lateral ones bearded near the base.

Viola chrysantha, *Hook. Ic.* 1, *t.* 49; *Torr. & Gray, Fl.* 1, *p.* 143. Hill sides and plains, Knight's ferry, Stanislaus, and Murphy's, California; May 8–14.

Viola pedunculata, *Torr. & Gray, Fl.* 1, *p.* 141. Sandy plains, Cocomungo, March 17; Benicia, April 24; Duffield's Ranch, Sierra Nevada, May 10. A pubescent form was collected near Santa Rosa creek, May 1. This species, V. præmorsa, *Dougl.*, V. linguæfolia, *Nutt.*, and V. Nuttalli, *Ph.*, are nearly allied, and should, perhaps, be united.

Viola sarmentosa, *Dougl. in Hook. Fl. Bor.-Am.* 1, *p.* 80; *Torr. & Gray, l. c.* Mountains near Oakland, April 4; Red woods, April 12.

Viola ocellata, *Torr. & Gray, Fl.* 1, *p.* 142. Deep ravines, Napa valley. Mr. Thurber found this species near the quicksilver mines of New Almaden.

Viola adunca, *Smith in Rees Cyclop.* V. longipes, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 140. Santa Rosa creek; May 1. The specimens are tall and slender, with the peduncles much elongated; but a short cespitose form of the plant (which is the same as Hartweg's No. 1660,) with the peduncles scarcely longer than the leaves, was collected at Duffield's Ranch, Sierra Nevada. There can be scarcely a doubt that the little known V. adunca of Smith is identical with Nuttall's V. longipes. The description of Smith agrees with our plant, but we have seen no authentic specimen for comparison.

Viola cucullata, *Ait.; Torr. & Gray, Fl.* 1, *p.* 139. Pecan creek, Arkansas, and on the Pecos. August–October; Cocomungo, California; March 18. The style is more slender and the stigma less rostrate in the Californian than in the eastern plant; but in other respects we find no difference.

Viola Canadensis, *Linn.* In the Sandia mountains, New Mexico; October. In flower and fruit.

HYPERICACEÆ.

Hypericum anagalloides, *Cham. & Schlecht. in Linnæa* 3, *p.* 127; *Torr. & Gray. Fl.* 1, *p,* 160. Wet places, Laguna Santa Rosa, May 1, and Punta de los Reyes, April 18. Leaves varying from oblong to broadly ovate, sparsely pellucid-punctate. Not very distinct from H. mutilum*.

* A remarkable shrub, bearing ripe pods only, was found by Dr. Bigelow in western New Mexico, on the hills bordering Williams' river, from near its source to its confluence with the Great Colorado. The Mexicans call it *Canotia.* It usually grows from 9 to 10 feet high, but was sometimes found attaining the height of nearly 20 feet. The branches are very numerous, alternate, rigid, terete, of a greenish color, and terminate in very long thorns. The epidermis is smooth and finely striate. Between the elevated striae there are 2 or 3 rows of impressed perforations. There were no leaves on the plant when Dr Bigelow saw it, and he thinks that it never bears any; but there are distant alternate brown scars, where minute leaves or scales appear to have been. The pedicles are somewhat racemose towards the summit of the branches. They are about half an inch long, somewhat spreading, then curved upward, and are articulated below the middle. Calyx persistent, 5-cleft, small, free from the ovary. The corolla, if any, is deciduous. Stamens 5, hypogynous; filaments slender and distinct. The fruit is nearly an inch long, oblong, acute at each end, and pointed with a short persistent subulate style, covered with a thin red flesh; the endocarp ligneous; 5-celled, septicidally dehiscent about two-thirds of the way down, and loculicidally at the summit, which thus presents 10 subulate points in pairs. Seed solitary in each cell, suspended from near the summit at the inner angle, oblong, compressed with a broad somewhat falcate wing at the inferior extremity. Testa coreaceo-chartaceous, dull, minutely granulated. Albumen very thin. Embryo nearly the length of the seed; cotyledons thin and flat. Radical inferior, terete, short, straight.

We can scarcely form a conjecture as to the affinities of this plant, but may note that the fruit is not unlike that of Eucryphia, which Lindley, following Choisy, refers to Hypericaceæ, nothwithstanding its superior radicle. The fruit has the same thin fleshy covering that occurs in our plant, and the large seeds (of which there are only three or four in each carpel) are also furnished with a conspicuous wing on the lower side; but the radicle is certainly superior. It is yet uncertain whether the New Mexican plant ever bears leaves. Dr. Bigelow saw it early in the spring, when other shrubby plants of the region were beginning to assume their foliage, but it was entirely naked. We must wait for other observations on this strange shrub, and especially for its flowers, before assigning it a place in the system. As, however, there can be but little doubt of its constituting an undescribed genus, we may bestow upon it the provisional name of *anotia holacantha*

CARYOPHYLLACEÆ.

SILENE CALIFORNICA, *Durand, Pl. Pratt. in Jour. Acad. Philad.*, (*n. ser.*) 2, *p.* 83. S. pulchra, *Torr. & Gray, Fl.* 1, *p.* 675; *excl. syn. Cham. & Schlecht.;* S. Virginica, *Benth. Pl. Hartw. No.* 1653. Sides of hills, Mammoth Grove, and Duffield's Ranch, Sierra Nevada, May; Mormon island, *Mr. Rich. var*? viscido-pubescens; foliis ovatis sessilibus, cymis subtrifloris; petalis profunde bipartitis, lobis bifidis, segmentis bidentatis v. integris. Valley of the Sacramento, Mr. Shelton. This variety has leaves sometimes as broad as those of S. latifolia. At the base of the limb of the petals there is remote linear lobe or tooth. In the specimens from Mormon island the middle lobes of the petals are somewhat toothed on the margin, especially near the summit. Lychnis pulchra, *Cham. & Schlecht.*, which was founded on a Mexican plant, seems clearly to be Silene laciiata, *Cav.* We are not sure that it grows in California, unless, which is possible, S. Californica passes into it.

SILENE QUINQUEVULNERA, *Linn.; Torr. & Gray, Fl.* 1, *p.* 191. Hills near Sonoma; May 3. Doubtless introduced from Europe.

SILENE DRUMMONDII, *Hook. Fl. Bor.-Am.* 1, *p.* 89; *Torr. & Gray, Fl.* 1, *p.* 91 *and* 675. Near San Francisco; April 8. On the Sandia mountains, New Mexico; October. In fruit.

SILENE ANTIRRHINA, *Linn.; Torr. & Gray, Fl.* 1, *p.* 191. Hill sides, Napa valley; April 16.

SAGINA DECUMBENS, *Torr. & Gray, Fl.* 1, *p.* 177. Spergula saginoides, *Linn.; Michx. Fl.* 1, *p.* 276. Damp places near San Francisco. Sepals and petals 4–5, equal in length. Stamens 10.

ALSINE DOUGLASII, *Fenzl.; Torr. & Gray, Fl.* 1, *p.* 674. Napa valley; April 26. Seeds orbicular-reniform, compressed, not margined.

ALSINE MICHAUXII, *Fenzl.* Arenaria stricta, *Michx. Fl.* 1. *p.* 274. Walnut creek; August: on rocks. In fruit.

ARENARIA MACROPHYLLA, *Hook. Fl. Bor.-Amer.* 1, *p.* 102, *t*, 37; *Torr. & Gray, Fl.* 1, *p.* 182. Mœhringia umbrosa, *Fenzl.?*; *Gray, Pl. Fendl. p.* 13. We are uncertain of the station of this plant, as the ticket belonging to it was lost; but it is probably the valley of the Sacramento. Dr. Bigelow's specimens are rather smaller than Nuttall's from Oregon, and the leaves are narrower. They accord pretty well with *Mœhringia umbrosa* from Songaria, in our herbarium, except that the leaves are narrower. Our California plant is not sufficiently mature to show the character of the seeds.

ARENARIA DIFFUSA, *Ell. Sk.* 1, *p.* 519; *Gray, Pl. Wright.* 2, *p.* 18. San Antonita, New Mexico; October.

ARENARIA FENDLERI, *Gray, Pl. Fendl. p.* 13. Laguna Blanca, in pine woods; September. The specimens bear mature fruit. The capsule is slightly longer than the calyx, and six-valved. Seeds obliquely obovate, with a minute uncinate micropyle, papillose-scabrous. Embryo unequally hyppocrepiforme.

STELLARIA JAMESII, *Torr. in Ann. Lyc. New York*, 2. *p.* 169. In the Sandia mountains; October. This striking species has not been collected, since its discovery by Dr. James, until now. The weak stems (a foot in length) and the older leaves are glabrous; the branches, etc., viscid-pubescent. The larger leaves are 3 or 4 inches long, and two-thirds of an inch in width.

STELLARIA NITENS. *Nutt. in Torr. & Gray, Fl.* 1. *p.* 184. Near San Gabriel, March 23. In our specimens the leaves are fringed with weak hairs, the lowest ones are oblong-ovate, on long petioles, the middle ones lanceolate-spatulate, and the uppermost linear. Sepals subulate-lanceolate, acuminate, 3-nerved. Petals oblong, deeply two-parted with linear segments. A similar form occurs in Oregon. We have also an apetalous triandrous state of the plant from hills near Murphy's; May 14.

STELLARIA LITTORALIS, (sp. nov.): undique pubescens; caule adscendente? superne cymoso-ramoso; foliis ovatis acuminatis basi rotundatis arcte sessilibus; pedicellis foliis vix longioribus; petalis profunde bipartitis, laciniis linearibus, sepala lanceolata excedentibus. Seashore, Punta

de los Reyes; April 17. Stems about a foot long, clothed, like the leaves, with a short woolly (and somewhat viscid?) pubescence. Leaves nearly an inch long and half an inch wide; the upper ones almost amplexicaul. Flowers few in leafy cymes, about as large as in Cerastium vulgatum. Sepals lanceolate, acute, obscurely 3-nerved. Petals about one-fourth longer than the sepals. Stamens 10. Styles rarely 4. Ovary and young fruit globose-ovate. This species resembles S. pubera, but that has less pubescence on the stem in two lines; the leaves are much larger, narrow at the base, and nearly smooth, except on the margin, and the sepals are broader as well as more obtuse. The present plant has much the aspect of a Cerastium, but the styles are almost invariably only three, and never five.

Cerastium oblongifolium, *Torr. in Sill. Jour.* 4, *p.* 63; *Torr & Gray, Fl.* 1, *p.* 188. Near Punta de los Reyes, California; April 17. Except in the larger flowers, we see nothing in which this differs from the eastern plant.

Paronychia ramosissima, *DC. Mém. Paronych. p.* 12, *t.* 4; *Torr. & Gray, Fl.* 1, *p.* 72. San Francisco; April 8.

Paronychia sessiliflora, *Nutt. Gen.* 1, *p.* 150; *Hook. Fl. Bor.–Amer.* 1, *p.* 226, *t.* 79. Gravelly natural mounds on the Canadian; September.

Paronychia dichotoma, *Nutt. l. c.* On the Canadian, in rocky prairies; August.

Drymaria glandulosa, *Bartl.; Gray, Pl. Wright.* 2, *p.* 18. La Cuesta, New Mexico, on mountains, under pine trees; September. A small state.

Spergularia rubra, *Pers. Syn.* 1, *p.* 504, (*Sect.* Arenariæ); *Gray Gen. Ill.* 2, *p.* 25, *t.* 107. Arenaria rubra, *Linn.* Spergula rubra, *Torr. & Gray, Fl.* 1, *p.* 174, *and Torr. & Gray, Fl.* 1, *p.* 157. Arenaria media, *Linn.* A. marginata, *DC. prodr.* 1, *p.* 401. Low places where the tide flows, Martinez, Corte Madera, &c.; April 10–23. All the specimens have the seed broadly margined.

PORTULACACEÆ.

Portulaca pilosa, *Linn.* Pecan creek, in dry, rocky places; August.

Portulaca retusa, *Engelm. in Pl. Lindh.* 2, *p*, 154. On the upper Canadian; September.

Calandrinia Menziesii, *Hook. Fl. Bor.–Amer.* 1, *p.* 223, *t.* 10; *Torr. & Gray, Fl.* 1, *p.* 197. Cocomungo, March 18, Corte Madera, April 20. C. speciosa, *Lindl.*, seems to be scarcely distinct from this species. Dr. Bigelow collected at Cahon Pass, March 16, a Calandrinia scarcely an inch high, but with conspicuous bright purple flowers. It is, probably, C. Menziesii in a very early state.

Claytonia Caroliniana, *Michx. Fl.* 1, *p.* 160; var. sessilifolia: minor, racemo foliis ovato-oblongis sessilibus vix longiore; petalis obovatis integris. C. lanceolata, *Hook. Fl. Bor.–Am.* 1, *p.* 234. On hills near Downieville, May 22. Whole plant only 2 or 3 inches high. Tuber globose, about half an inch in diameter. There were no radical leaves on any of the numerous specimens. Stem leaves from half an inch to three-fourths of an inch or more in length. Raceme 6–10-flowered, a little overtopping the leaves, even when the lower capsules were nearly mature. Flowers about half as large as in the eastern plant. (They are quite as large in specimens of C. lanceolata, *Hook.*, collected in the Rocky mountains by Burke). Calyx one-third the length of the petals. Corolla apparently pale rose-color. This is the only perennial (corm-bearing) Claytonia that we have received from California. Pursh's C. lanceolata (as intimated in the Flora of North America), is a spurious species, made up of C. Caroliniana and C. alsinoides. The leaves, in all the species of this genus that we have examined, are furnished with a fine intra-marginal vein, in which all the veinlets terminate.

Claytonia alsinoides, *Sims, Bot. Mag. t.* 1309; *Torr. & Gray, Fl.* 1. *p.* 199. Marshes, Punta de los Reyes, April 17; deep woods, Bolinas bay, April 19.

Claytonia perfoliata, *Don, Hort. Cant. ed.* 4, *p.* 50; *Bot. Mag. t.* 1335; *Torr. & Gray, l. c.* Corte Madera, April 12; Cocomungo, March 18; Cajon creek, March 18. In the specimens from the

two latter stations, some of the radieal leaves are rhomboidal, others are linear-spatulate, showing a tendency to pass into C. parviflora.

C. PERFOLIATA, var. PARVIFLORA : foliis radicalibus lineari-spathulatis, caulinis in unum ovale perfoliatum coalitis. C. parviflora, *Dougl. in Hook. Fl. Bor.-Amer.* 1, *p.* 225, *t.* 73; *Torr. & Gray, l. c.*; C. gypsophiloides, *Fisch. & Mey. Index. Sem. St. Petersb.* (1835), *p.* 33. Hills, Middle Yuba (fine specimens, nearly a foot high). A dwarf form was collected near San Francisco, April 3.

C. PERFOLIATA, var. EXIGUA : nana; radicalibus anguste linearibus; caulinis lanceolatis vel linearibus, subconnatis. C. exigua, *Torr. & Gray, Fl. l. c.* San Francisco; April

A careful examination of our numerous specimens of annual Claytoniæ has led us to reduce several species to C. perfoliata, and we would add to the list of varieties C. spathulata. Intermediate forms connect all these. Hereafter it may be found necesasry to include C. tenuifolia.

CLAYTONIA LINEARIS, *Dougl. in Hook. Fl. Bor.-Am.* 1, *p.* 224, *t.* 71; *Torr. & Gray, l. c.* Wet places, Napa valley; April 26. The specimens are considerably larger than those of Douglas. The seeds are larger than in any other species of this genus; they are lenticular, acute on the margin, and highly polished. A very distinct species.

MONTIA FONTANA, *Linn.; DC. Prodr.* 3, *p.* 361; *Torr. & Gray, Fl.* 1, *p.* 202. In water; Duffield's ranch, Sierra Nevada, May 11; San Francisco, April 8; Corte Madera, April 20. On the western side of America, the range of this plant extends from Sitcha to Quito, but on the eastern side it has not been found south of Newfoundland. Chamisso (in Linnæa 6, p. 565) considers the Quito plant as a distinct species, which he calls M. lamprosperma, and states that it occurs also in the island of Unalaschka, and at the Bay of Eschscholtz. In plate 7, figs. 1–2, of the volume quoted, he has given figures of the seeds of that species, and of M. fontana. Our Californian plant has exactly the seeds of M. fontana, and Mr. Nuttall's Oregon specimens have the same; but M. fontana *β.* from Sitcha, is M. lamprosperma of Chamisso. We find the seeds to vary in size and color, and Dr. J. D. Hooker, in *Fl. Antarct.*, *p.* 13, has shown that the two species are almost certainly not distinct.

LEWISIA REDIVIVA, *Pursh, Fl.* 1, *p.* 368; *Hook. Bot. Misc.* 1, *p.* 344, *t.* 70; *Torr. & Gray, Fl.* 1, *p.* 677. Rocky places, Napa valley; April 25. This interesting plant extends as far south as the American fork of the Sacramento.

STERCULIACEÆ.

FRÉMONTIA CALIFORNICA, *Torr. in Smithson. Contrib.* 6, *p.* 5, *t.* 2. Cajon Pass of the Sierra Nevada. The plants found by Dr. Bigelow were about 15 feet high, which is much taller than the specimens seen by Col. Frémont and Rev. Mr. Fitch. They were bearing ripe fruit on the 16th of March, which must have been formed the previous season. The capsules are in perfect condition, and show that no part of the calyx is deciduous. The seeds are about as large as in Hibiscus Syriacus, ovate, black, smooth, and somewhat shining. Testa thick and crustaceous. Embryo straight, lying in fleshy and oily albumen; cotyledons ovate, foliaceous, nearly flat. In all of Dr. Bigelow's specimens of the Frémontia, the leaves were small, few of them being more than an inch in diameter.

MALVACEÆ.

CALLIRRHÖE INVOLUCRATA, *Gray, Pl. Fendl., p.* 15, *and Gen. Ill. t.* 117. On the Canadian; September.

MALVASTRUM COCCINEUM, *Gray, l. c.* Upper Canadian, and near Galisteo, New Mexico.

MALVA BOREALIS, *Wallm.; Gray, Pl. Fendl., p.* 15. M. obtusa, *Torr. & Gray, Fl.* 1. *p.* 225, A common weed in California.

SIDALCEA DIPLOSCYPHA, *Gray, Gen. Ill.* 2, *t.* 222; *Plant. Fendl., p.* 19. Sida diploscypha. *Torr. & Gray, Fl.* 1, *p.* 234. Plains, Ione valley, California; May 18.

STELLARIA HIRSUTA, *Gray, Pl. Wright.* 1, *p.* 16. S. delphinifolia, *Gray, Pl. Fendl., p.* 19, *and Gen. Ill.* 2, *t.* 12, *f.* 10–12, *and in Benth. Pl. Hartw. p.* 300, *excl. syn. Nutt.* In low places, on the sides of rivulets; Knight's ferry, Stanislaus river, California; May 7.

STELLARIA HARTWEGI, *Gray, Pl. Fendl., p.* 209, *and in Benth. Pl. Hartw., p.* 300. Plains and hill-sides, Napa valley; May 5. Fine specimens of this rare plant are in the collection; some of them are sparingly branched above, and the racemes are somewhat compound. The fruit is still unknown.

STELLARIA MALVÆFLORA, *Gray, Pl. Wright.* 1, *p.* 16. Sida malvæflora, *Moç. & Sesse.; DC. Prodr.* 1, *p.* 194. Sidalcea Neo-Mexicana, *Gray, Pl. Fendl. p.* 23. S. Oregana, *Gray, l. c.* Mokelumne hill, May 17; plains of Napa valley, May 5.

STELLARIA HUMILIS and var. *β. Gray Pl. Fendl. p.* 20. Hills near Oakland, April 5; Punta de los Reyes, April 18; *β.* Napa valley. Perhaps not distinct from S. malvæflora.

SIDA LEPIDOTA, var. SAGITTÆFOLIA, *Gray, Pl. Wright.* 1, *p.* 18. Plains, Laguna Colorado; September.

SIDA SPINOSA, *Linn.* Shawneetown, Indian Territory; August.

ABUTILON PARVULUM, *Gray, Pl. Wright.* 1, *p.* 21. Rocky hills near Anton Chico; September.

SPHÆRALCEA ANGUSTIFOLIA, var. (S. stellata, Torr. & Gray.) Plains of the Upper Canadian, etc.; September.

STELLARIA INCANA? Var. OBLONGIFOLIA, *Gray, Pl. Wright.* 2, *p.* 21. Galisteo, in low places; October.

HIBISCUS MOSCHEUTOS, Linn. Sandy bottoms of the Canadian; September.

LINACEÆ.

LINUM PERENNE, *Linn.* Gravelly hills and plains near Galisteo, New Mexico; October. In fruit.

LINUM RIGIDUM, *Pursh, Fl.* 1, *p.* 210; *Gray, Pl. Wright.* 2, *p.* 25. Prairie hills, on the Canadian; September.

LINUM CALIFORNICUM, *Benth. Plant. Hartw. p.* 298. Plains of Feather river, near Marysville; May 25. Petals rose color in the bud; white when expanded. In all the flowers that we examined, there were but 3 styles, and the ovary was tricarpellary. Some of our specimens are more than a foot high.

GERANIACEÆ.

GERANIUM CAROLINIANUM, *Linn.; Torr. & Gray, Fl.* 1, *p.* 207. Corte Madera, April 12; hill-sides, Murphy's, May 14. One of the most widely diffused plants of North America.

GERANIUM RICHARDSONII, *Fisch. & Meyer; Engelm. in Pl. Fendl. p.* 26. G. albiflorum, *Hook.* In the Sandia mountains, New Mexico; October.

GERANIUM CÆSPITOSUM, *James, in Long's Exped.; Gray, Pl. Fendl. p.* 25. Mountain arroyas, near San Antonita; October. A low and diffuse state, mostly in fruit, and an erect form, near Wright's No. 910, but with long peduncles.

ERODIUM MACROPHYLLUM, *Hook. & Arn. Bot. Beech., p.* 227; *Torr. & Gray, Fl.* 1, *p.* 679. Hill-sides, Murphy's, May 14. All the specimens are small leaved.

ERODIUM CICUTARIUM, *L'Herit.; DC. Prodr.* 1, *p.* 646; *Torr. & Gray, Fl.* 1, *p.* 208. In various parts of New Mexico; also plains near Los Angeles, and on Williams' river, near the Colorado, February and March. In the specimens from the latter station the leaves are more cut than usual.

OXALIDACEÆ.

OXALIS OREGANA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 211. O. Acetosella, *Hook. Fl. Bor.-Am.* 1, *p.* 118, (ex parte.) Tamul Pass, April 11. Perhaps not distinct from O. Acetosella; the chief difference being the greater proportionate breadth of the leafless. The rhizoma is some-

times a foot or more in length. It is only the portion near the leaf-bearing extremity that has the scales imbricated; on the other parts they are distant and alternate.

OXALIS STRICTA, *Linn.; Torr. Fl., New York*, 1, *p.* 123. Plains near San Gabriel, March 23.

LIMNANTHACEÆ.

LIMNANTHES ROSEA, *Benth. Pl. Hartw., p.* 302; "*Jour. Hort. Soc.* 4, *t.* 78." Low wet places, Corte Madera; Stanislaus; Los Angeles, etc. March—May. Scarcely distinct from L. Douglasii; the divisions of the leaves being, in some of Douglas' original specimens, quite as narrow as those of L. rosea. In cultivated specimens of the latter the ultimate segments of the leaves are broader than in the wild plant.

LIMNANTHES ALBA, *Benth. l. c.* Hill-sides, Duffield's ranch, Sierra Nevada, May 12. This seems to be a very distinct species, and is obviously distinguished by its hairiness.

RUTACEÆ.

THAMNOSMA MONTANUM, (Torr. & Frém.:) fruticosum, ramosissimum; ramis spinescentibus; foliis crassiusculis lineari-spathulatis obscure punctatis; antheris sagittatis promisse mucronatis; disco parvo stipite fructifero (sesquilineari) columnari multum breviore; capsula didyma basi retusa; seminibus cochleatis lævibus. (Tab. III.)—*Torr. & Frém. in Frém. 2d. Rep., p.* 313. Dry ravines of the Mohave, near the Colorado, March 3–9. The description in the work here quoted was drawn from imperfect materials, and the plant was incorrectly referred to Zanthoxylaceæ, instead of Rutaceæ proper. The æstivation of the corolla is imbricated, not valvate. The stamens and filiform style are more or less exserted. Stigma small and capitate. Albumen thin. Rutosma of Gray must be included in this genus.

PTELEA TRIFOLIATA, *Linn.* B. MOLLIS, *Torr. & Gray, Fl.* 1, *p.* 680; *Gray, Pl. Wright.* 1, *p.* 31. Rocky hills of the Upper Canadian; September. In fruit.

ANACARDIACEÆ.

RHUS TRILOBATA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 219. Hilly prairies on the Canadian; September. In fruit.

RHUS DIVERSILOBA, *Torr. & Gray, Fl.* 1, *p.* 218. R. lobata, *Hook. Fl. Bor. Am.* 1, *p.* 127, *t.* 46, *non Poir.* Plains and mountains near San Gabriel, March 23; Martinez, April 23. The specimens are all male.

STYPHONIA INTEGRIFOLIA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 220; *Nutt. Sylv.* 3, *p.* 4, *t.* 82. Ravines, Cojon Pass; March 17. The leaves are three inches long, and nearly two inches wide, ovate, with a short acumination. Dr. Parry collected similar specimens near Santa Barbara. S. serrata is probably not a distinct species.

LITHRÆA LAURINA, *Walp. Repert.* 1, *p.* 551. Rhus laurina, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 219. Near San Gabriel, March 23, (in fruit; doubtless of the preceding season.) The thin pulp of the dry fruit consists chiefly of a white waxy material, which is soluble in very strong alcohol, and seems to be almost entirely cerine.

VITACEÆ.

VITUS INCISA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 241. Gypsum rocks, Elm creek; August.

VITUS RUPESTRIS, *Scheele in Linnæa* 21, *p.* 291, On the Canadian, Pecos, etc. August—September. In fruit.

ACERACEÆ.

NEGUNDO ACEROIDES, *Mœnch.* In a cañon on the Pecos; September. In fruit.

ACER TRIPARTITUM, *Nutt. in Torr. & Gray, Fl.* 1, p. 247; Gray, Pl. Fendl., p. 28. Arroyas

in the Sandia mountains; October. In fruit. While some of the leaves are trifoliate, others on the same branch are only three-lobed, and so much resemble those of A. glabrum that the species probably cannot be kept distinct.—*Gray, Mss.*

Acer macrophyllum, *Pursh, Fl.* 1, *p.* 267; *Hook. Fl. Bor.-Am.* 1, *p.* 112, *t.* 38; *Nutt. Sylv.* 2, *p.* 76, *t.* 67.

Negundo aceroides, *Mœnch. Meth., p.* 334; *Torr. & Gray, Fl.* 1, *p.* 260; N. Californicum, *Torr. & Gray, l. c.; Nutt. Sylv.* 2, *p.* 90, *t.* 72. Acer Negundo, *Linn.* Corte Madera, April 10, (in flower.)

SAPINDACEÆ.

Æsculus Californica, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 251; *and Sylv.* 2, *p.* 69, *t.* 64. Hill-sides, Sonoma, May 3, in flower; mountains near Oakland, (leaves only.)

Æsculus flava, *Art.; Pursh, Fl.* 1, *p.* 255. On the Canadian, near the Shawnee villages, and Deer creek; August. In fruit.

Sapindus marginatus, *Willd.; Gray, Gen. Ill.* 2, *t.* 180. Creek bottoms, on the Upper Canadian; September. In fruit.

Cardiospermum Halicacabum, *Linn.* Deer creek; August.

CELASTRACEÆ.

Pachystima Myrsinites, *Raf. in Amer. Month. Mag.*, 1818; *Gray, Pl. Fendl., p.* 29. Ilex? Myrsinites, *Pursh, Fl.* 1, *p.* 119. Oreophila myrtifolia, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 259.—Sandia mountains, New Mexico; October; in fruit. Hill-sides. South Yuba, California; May 26. The leaves are larger than in the Oregon plant, and sharply serrate. The woody stem is of extremely slow growth, several annual circles being included with one-tenth of an inch.

Euonymus occidentalis, *Nutt. Mss.* E. atropurpureus *β*? *Torr. & Gray, Fl.* 1, *p.* 258. Head of Tomales bay; April 17. Leaves ovate, mostly obtuse, at the base quite smooth. Peduncles 3-flowered. Flower pentamerous, larger than in E. atropurpureus. The fruit is unknown.

Celastrus scandens, *Linn.* Pecan creek; August. In fruit.

Glossopetalon spinescens, *Gray, Pl. Wright.* 2, *p.* 29, *t.* 12. Cañons in the Llano Estacado; September. Without flowers or fruit.

RHAMNACEÆ.

Rhamnus croceus, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 261. Hills near Sonora, May 9; Rocky hills, 80 miles west of the Colorado. Leaves often green underneath.

Frangula Californica, *Gray, Gen. Ill.* 2, *p.* 178; *and Pl. Wright.* 2, *p.* 28. Rhamnus Californicus, *Esch.; Torr. & Gray, Fl.* 1, *p.* 263. R. oleifolius, *Hook. Fl. Bor.—Am.* 1, *p.* 123, *t.* 44. R. laurifolius, *Nutt. in Torr. & Gray, Fl. l. c.* Hill-sides, Robinson's ferry, Stanislaus, May 14; a variety, with larger leaves, softly pubescent on both sides; Napa valley, May 5, (leaves nearly glabrous both sides, and with obtuse serratures;) mountains near San Gabriel, March 23, (glabrous leaves, with acute serratures): var. tomentella, *Gray, Pl. Wright. l. c.* Rhamnus tomentellus, *Benth. Pl. Hartw. p.* 303. Butte mountains, near Marysville, May 25. A plant of very diverse appearance; but its extreme forms pass insensibly into each other. In favorable situations it attains the height of 18 feet.

Ceanothus thyrsiflorus, *Esch.; Torr. & Gray, Fl.* 1, *p.* 266; *Bot. Reg.* 30, *t.* 38; *Nutt. Sylv.* 2, *p.* 43, *t.* 57. Punta de los Reyes, April 18; San Francisco, April 3; hill-sides, Napa valley, April 27. A beautiful shrub, known in its native country under the name of California lilac.

Ceanothus sorediacus, *Hook. & Arn. Bot. Beech. p.* 328; *Torr. & Gray, Fl. l. p.* 686. Hill-sides, Grass valley; May 9–19. A neat little shrub, 4–5 feet high, (sometimes prostrate,) with

numerous clusters of bright-blue flowers, and resembling C. thyrsiflorus, only much smaller. A trailing form, with more pubescent branches and leaves, and short-peduncled panicles, was found at Duffield's ranch, Sierra Nevada, (May 12,) and at the Washington Mammoth grove, (May 15.)

CEANOTHUS DIVARICATUS, *Nutt. in Torr. & Gray, Fl. l. c.* Var.? GROSSE-SERRATUS: foliis majoribus, grosse-serratus, acutiusculis. Station not recorded. Branches thorny at the extremity; serratures of the leaves acute; flowers blue.

CEANOTHUS INCANUS, *Torr. & Gray, Fl.* 1, *p.* 265. A single specimen, of a slender form, of this species exists in the collection. It is without a ticket, but was probably found in the valley of the Sacramento.

CEANOTHUS CRASSIFOLIUS, (*Torr. in Emory's Mex. Bound. Rep., cum tab. ined.*:) fruticosus, ramulis pubescentibus; foliis ovatis, integerrimis, vel remote spinuloso-denticulatis coriaceis crassis penninerviis, supra demum glabratis, subtus albo-tomentosis, thyrsis subsessilibus umbelliformibus (floribus albis.) Hills and sandy plains, Cajon Pass, March 16; Teyung, California, *Mr. Wallace*, 1854. Dr. Parry discovered this well-marked species in the mountains south of Los Angeles, while acting as botanist, under Major Emory, in the Mexican boundary survey.

CEANOTHUS INTEGERRIMUS, *Hook. & Arn. Bot. Beechey, p.* 329; *Torr. & Gray, Fl. l. c.; Benth. Pl. Hartw. p.* 302, *No.* 1684. Grass valley, May 20; Los Angeles, May 14; hill-sides, Nevada, May 20.

CEANOTHUS DIVARICATUS, *Nutt. l. c. var.* EGLANDULOSUS: foliis integerrimis (margine nec denticulatis glanduliferis) obtusissimis. On mountains near San Gabriel; March 22. Also with vestiges of last year's fruit. Cohon Pass, March 16. (Collected by Dr. Parry on the mountains east of San Diego; in fruit and in flower by Mr. Wallace, at Boca de Teyunga, April.) This has the flowers, the divaricate spinescent branches with whitish bark, and also the foliage of C. divaricatus, except that none of the specimens show a trace of the glandular denticulations so manifest in the specimens of Douglas and of Coulter; nor is the pubescence on their ribs quite so evident. Some of the leaves are slightly cordate.—*Gray, Mss.*

CEANOTHUS CUNEATUS, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 267. C. macrocarpus, *Nutt. l. c.*, (non *Cavan.*) Cocomungo, March 17; San Giovana, April 12; Napa valley, April 27; Knight's ferry, Stanislaus, May 7, (fruit.) A very variable species in the size and form of the leaves. It should, perhaps, include *C. verrucosus* of Nuttall.

CEANOTHUS DENTATUS, *Torr. & Gray, Fl.* 1, *p.* 268; *Lindl. & Paxt. Fl. Gard.* 1, *p.* 17, *t.* 4. Santa Rosa Laguna; May 1. This pretty species has much the appearance of C. sorediacus, but the leaves are hardly 3-nerved.

CEANOTHUS RIGIDUS, *Nutt. in Torr. & Gray, Fl. l. c.; Lindl. & Paxt. Fl. Gard.* 1, *p.* 74, *t.* 51; *Bot. Mag.* 78, *t.* 4664. Var. GRANDIFOLIUS. Punta de los Reyes; April 18. The leaves are three times larger than in the ordinary form of this species, and strongly spinose-toothed on the sides, as well as at the extremity. This variety seems to show almost a transition to C. prostratus, through the broad-leaved form of that plant noticed below; but we are not willing to unite the two species, without seeing a more extensive suite of specimens for comparison.

CEANOTHUS PROSTRATUS, *Benth. Pl. Hartw. p.* 302. Grass valley, May 20; with immature fruit. The leaves vary from oblanceolate and entire to cuneate and tricuspidate. The fruit is crowned with 3 strong protuberances. A variety, with much larger obovate-cuneate leaves, coarsely spinose-toothed down to the middle, or at the apex only, was found at the Washington Mammoth grove. Colonel Frémont collected the same on the Upper Sacramento in 1846.

CEANOTHUS FENDLERI, *Gray, Pl. Fendl. p.* 20. Sandia mountains; October. In fruit.

MESEMBRYANTHEMACEÆ.

MESEMBRYANTHEMUM DIMIDIATUM, *Harv.?* Sea-shore, Punta de los Reyes, April 18. The plant is abundant in several other places on the coast of California, and was probably introduced.

FRANKENIACEÆ.

Frankenia grandifolia, *Cham. & Schlect. in Linnæa* 1, *p.* 35; *Torr. & Gray, Fl.* 1, *p.* 168. Corte Madera; April 10.

POLYGALACEÆ.

Polygala cucullata, *Benth. Pl. Hartw. p.* 229. Hill-sides, Napa valley; April 27. We have seen no other Polygala from California, nor from any other part of the Pacific coast, and we strongly suspect that *P. Nutkana, Moç. Sesse.* (if really from the northwest coast) and *P. Californica, Nutt.*, are not distinct. The leaves are variable in breadth. In some of Frémont's specimens, collected on the Sacramento, they are acute at the base, and the apex is scarcely blunt. The little appendage which takes the place of this crest at the summit of the keel is sometimes rostrate, and either straight or curved. Although there are no flowers or radical sarments in Dr. Bigelow's specimens, there are vestiges of them, and it is probable that in the early state of the plant it usually produces such flowers.

Polygala Lindheimeri, *Gray, Pl. Lindh.* 2, *p.* 150. On the Llano Estacado; September. A form with mostly linear leaves.

KRAMERIACEÆ.

Krameria lanceolata, *Torr. in Am. Lyc., New York,* 2, *p.* 168. Sandy prairies on the Canadian; August.

LEGUMINOSÆ.

Vicia exigua, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 272; *var.?* Californica. River banks, Benicia, April 24. We have not seen the Californian variety of the plant noticed by Mr. Nuttall. The specimens collected by Dr. Bigelow seem to be quite as near V. exigua, and perhaps the two species are not distinct. The former has been found in Alabama by Mr. Buckley, and in Florida by Dr. Chapman. All the specimens of Dr. Bigelow have single-flowered peduncles, which are of not half the length of the leaves. They are usually 6 leaflets, which are about an inch long and two lines wide, glabrous and emarginate, with a mucro, or acute and entire. The stipules are minute, and narrowly semi-sagittate. The pod is fully an inch long, sabre-shaped, and 5–7-seeded.

Vicia gigantea, *Hook. Fl. Bor.–Amer.* 1, *p.* 157; *Torr. & Gray, Fl.* 1, *p.* 270. Mountains near Oakland; April 4; Punta de los Reyes, April 18. This agrees well with our Oregon specimens from Dr. Scouler and Mr. Nuttall, except that the lower teeth of the calyx are not so long. It also occurs in Coulter's Californian collection.

Vicia Oregana, *Nutt. in Torr. & Gray, Fl. l. c.* V. truncata, *Nutt. l. c.* Mountains, near Oakland, April 4; hill-sides, Benicia, April 24. We find Nuttall's two species to run into each other.

Lathyrus vestitus, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 276. Var.? multiflorus: foliolis ovato-oblongis, pedunculis folio multo longioribus 20–25-floris, dentibus inferioribus calycis superioribus triplo-longioribus. Hills, Tomales bay, April 19; Corte Madera, April 10. About one foot high, clothed with a short soft pubescence. Leaflets 6 pairs, nearly three-fourths of an inch long, cuspidate. Peduncles 2–3 times longer than the leaves. Flowers nearly as large as in L. palustris. Lower teeth of the calyx linear-lanceolate, three times longer than the upper triangular ones. Stipules lanceolate, semi-sagittate, entire.

Lathyrus venosus, *Muhl. in Willd. Sp.* 3, *p.* 1092? *Torr. & Gray, Fl.* 1, *p.* 274, (the var. γ.;) *Benth. Pl. Hartw., No.* 1705. L. decaphyllus, *Hook. Fl. Bor.–Amer.* 1, *p.* 159; non Pursh. Grass valley, May 19. A stout plant, with a winged stem. Leaflets 6 pairs, an inch and a

half long, ovate-elliptical, minutely pubescent on both sides. Peduncles 4–6 inches long, (exclusive of the 10–14-flowered raceme.) Upper teeth of the calyx very short, and broadly triangular, with a minute point; all the teeth shorter than the tube. The stipules are larger than in the eastern plant, but much smaller than the leaves. We have not seen the pods.

Lathyrus venosus, var. grandiflorus: caule nudo; foliolis (subdecum) minoribus supra glabris; pedunculis folio subduplo longioribus; floribus maximis, dentibus calycis tubo subæqualibus. Cocomungo, March 17. The flowers are twice as large as in the ordinary form of this species.

Lathyrus venosus, var. *δ. Torr. & Gray, l. c.* L. pubescens, *Nutt. Mss.* Hill-sides, Benicia; April 24. This agrees with our Oregon specimens from Nuttall. It is between L. venosus and vestitus, and seems almost to unite the two species.

Lathyrus venosus: var. obovatus: caule nudo; foliolis sub-4-jugis plerumque obovatis obtusis puberulis; racemo 3–4-floro; calycis dentibus subæqualibus. Near the Mammoth Grove and at Duffield's Ranch, Sierra Nevada, May 15. A mountain form, with larger flowers than usual.

Lathyrus ochroleucus, *Hook. Fl. Bor.-Am.* 1, *p.* 159? Var. pedunculis 12–20-floris, folio subæquantibus. Hill-sides, Murphy's, May 12. Leaflets of a firm texture, and more approximated than in the eastern plant.

We are by no means satisfied with the results of our examination of the Lathyri in Dr. Bigelow's collection. The species of this genus are extremely variable, especially those of Oregon and California. It is possible that the true L. venosus does not grow on the northwest coast; but we have not been able to discover characters sufficient for distinguishing from that species any of the varieties enumerated above.

Lathyrus polymorphus, *Nutt. Gen.* 2, *p.* 97; *Gray, Pl. Fendl.*, *p.* 30. Laguna Colorado, New Mexico, September; and Santa Domingo, October; in low and wet places.

Orobus littoralis, *Gray, in Stevens' Rep. ined.* Astrophia littoralis, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 278. Specimens of this plant were given to Dr. Bigelow by Dr. Andrews. They were probably collected on the coast, near San Francisco.

Phaseolus diversifolius, *Pers.; Torr. & Gray, Fl.* 1, *p.* 279. Sand banks of the Canadian River, near the Shawnee villages, etc. August.

Phaseolus pauciflorus, *Benth.; Gray, Pl. Wright.* 1, *p.* 44. With the preceding.

Amphicarpæa monoica, *Torr. & Gray, Fl.* 1, *p.* 292. Ravines of Pecan creek; August.

Psoralea physodes, *Dougl. in Hook. Fl. Bor.-Amer.* 1, *p.* 304; *Torr. & Gray, Fl.* 1. *p.* 304 *and* 689. Near Mark West's Creek, California. April 30. The stem is wholly free from glands.

Psoralea cuspidata, *Pursh, Fl.* 2, *p.* 741. Rocky hills of the upper Canadian; September. In fruit.

Psoralea digitata, *Nutt. in Torr. & Gray, Fl.* 1. *p.* 301. Sand-banks of the Canadian, near the Shawnee villages; August. In fruit.

Psoralea linearifolia, *Torr. & Gray, l. c.* Gypsum hills, Comanche plains; September.

Psoralea micrantha (sp. nov.): cinereo-puberula, minute glanduloso-punctata; caulibus e radice seu rhizomate longissimo repente assurgentibus paniculato-ramosissimis; stipulis subulatis minimis; foliis palmatim trifoliolatis; foliolis lineari-filiformibus incisve anguste linearibus mucronato-acutis; pedunculis folio paullo brevioribus; spica brevi densiflora; bracteis minimis caducis; calycis dentibus brevibus obtusissimis; fructu glabro.—Sand hills, near the last camp on the upper Canadian; September. Plant a foot high, from a horizontal root or slender rootstock of several feet in length. Branches slender, leafy. Leaflets an inch or less in length, canaliculate and nearly filiform, or the lowest flat and about a line wide, punctate with fine brown dots. Peduncles half an inch long, about the length of the subtending petioles, bearing a short and oval or oblong spike of 10–20 small flowers, which are usually closely approximate or crowded. Calyx short, scarcely a line long, rather longer than the pedicel, campanulate, dotted with coarse brown glands; the short teeth broad and very obtuse, equal. Corolla barely a line and a half long beyond the calyx, narrow, white, except the tip of the keel, which is blue.

Anthers uniform. Fruit globular, flattened, glabrous or nearly so. This should be compared with P. laxiflora, *Nutt.*, which we have never seen, and which is compared with P. lanceolata, a species having much affinity with the present one. Nuttall's plant, however, is characterized as having the leaflets longer than P. lanceolata, and linear or oblong, the peduncles longer than the leaves, the flowers somewhat distant, etc.—*Gray, Mss.*

Amorpha canescens, *Nutt. Gen.* 2, *p.* 92. Prairies Indian Territory; August.

Petalostemon violaceum, *Michx. Fl.* 2, *p.* 50, *t.* 37. Sand banks of the Canadian river, near the Shawnee villages; August.

Petalostemon multiflorum, *Nutt.; Torr. & Gray, Fl.* 1, *p.* 309. Prairies on the Canadian, near Delaware mountain; August.

Petalostemon villosum, *Nutt. Gen.* 2, *p.* 85; *Torr. & Gray, l. c.* Sand banks of the Canadian, near the Shawnee villages; August.

Dalea spinosa, *Gray, Plant. Thurb. p.* 315. Arroyos near Williams' River of the Colorado, New Mexico; February 16. In fruit.

Dalea formosa, *Torr. in Anner. Lyc. New York*, 2, *p.* 178, & *in Emory's, Rep. t.* 1. Rocks and cañons on the upper Canadian; September.

Dalea laxiflora, *Pursh, Fl.* 2, *p.* 741. Prairies of the upper Canadian; August.

Dalea alopecuroides, *Willd.* Santo Domingo, New Mexico, on the banks of streams; October.

Dalea lanata, *Spreng. Syst.* 3, *p.* 327. Sand banks of the Canadian, near the Shawnee villages; August.

Dalea nana, *Torr. in Pl. Fendl. p.* 31. Plains of the upper Canadian and New Mexico; September—October.

Dalea aurea, *Nutt. Gen.* 2, *p.* 101. Prairies of the upper Canadian; September.

Dalea Jamesii, *Torr. & Gray, Fl.* 1, *p.* 308. Plains of the upper Canadian; September.

Trifolium involucratum, *Willd.; Benth. Pl. Hartw. n.* 54; *Gray, Pl. Fendl. p.* 33. Banks of streams near Santo Domingo, New Mexico; October.

Trifolium Macræi, *Hook. & Arn. in Hook. Bot. Misc.* 3, *p.* 179, & *Bot. Beech. p.* 330. T. albopurpureum, *Torr. & Gray, Fl.* 1, *p.* 313. Corte Madera, April 10; in fields, Benicia, April 23; Napa valley, April 26. Variable in height, size of heads, and form of the leaves.

Trifolium dichotomum, *Hook. & Arn. Bot. Beech. p.* 330; *Torr. & Gray, Fl.* 1. *p.* 691. The station of this plant is uncertain, as no ticket accompanied the specimen, but it was probably collected near San Francisco. We are not certain that it is a distinct species from the preceding, although so much larger in all its parts.

Trifolium ciliolatum, *Benth. Pl. Hartw. p.* 304. Corte Madera, April 12; Benicia, California; April 23. We have specimens of this plant from the valley of the Sacramento, collected by Dr. Stillman and Mr. Shelton.

Trifolium gracilentum, *Torr. & Gray, Fl.* 1, *p.* 316. Corte Madera, April 10; Napa valley, April 26; Hill sides, Sonoma, California; May 3.

Trifolium microcephalum, *Pursh, Fl.* 2, *p.* 478; *Torr. & Gray, Fl.* 1, *p.* 317. Tamul Pass, California; April 11.

Trifolium heterodon, *Torr. & Gray, Fl.* 1, *p.* 318. Low wet places, near San Francisco; April 3–8. Legume 4–5-seeded. A good species.

Trifolium tridentatum, *Lindl. Bot. Reg. sub. t.* 1070. T. involucratum, *Torr. & Gray, l. c., non Willd.* Corte Madera, April 12.

Trifolium microdon, *Hook. & Arn. Bot. Misc.* 3, *p.* 180; & *Bot. Beechey, p.* 330, *t.* 79. Hill-sides, Sonoma, California; May 3.

Trifolium fucatum, *Lindl. Bot. Reg. t.* 1883; *Torr. & Gray, Fl.* 1, *p.* 619. Los Angeles, March 21; Benicia and Martinez, April 23–24.

Trifolium amplectens, *Torr. & Gray, Fl.* 1, *p.* 319. Corte Madera, April 10; and San Francisco, April 3; hill-sides, Benicia, April 24.

TRIFOLIUM BARBIGERUM, (sp. nov.): nanum, molliter pubescens; caulibus e radice annua vel bienni adscendentibus, (1–3 poll. longis,) junioribus stipulis scariosis apice truncato setaceo-laciniatis imbricatum vestitis; foliolis obovatis cuneatisve obtusissimis denticulatis; involucro cyathiformi laciniato aristato-dentato flores subæquante; calycis dentibus tubo fere triplo longioribus aristiformi-subulatis plumoso-barbatis, infimo simplici præsertim supremo bi-trifidis; leguminibus dispermis. Near San Francisco, April. The Rev. A. Fitch collected this plant in the same place, four or five years ago.

MELILOTUS PARVIFLORA, *Desf. Fl. Atl.* 2, *p.* 192; *Torr. & Gray, Fl.* 1, *p.* 321. Common in New Mexico and California, on banks of streams; probably introduced.

MEDICAGO DENTICULATA, *Willd. Sp.* 3, *p.* 1414; *Torr. & Gray, Fl.* 1, *p.* 332. Cocomungo, California; March 18. Introduced.

HOSACKIA BICOLOR, *Dougl. et Benth. in Bot. Reg. t.* 1257; *Hook. Fl. Bor.-Am.* 1, *p.* 134; *Torr. & Gray. Fl.* 1, *p.* 323. Hills near Punta de los Reyes; April 17; and wet ravines, Grass Valley, California; May 19. A showy perennial species. The stipules are not always "very obtuse," but are sometimes rather acute.

HOSACKIA STOLONIFERA, *Lindl. Bot. Reg. t.* 1977; *Torr. & Gray, Fl.* 1, *p.* 323. River banks, Mokelumne Hill, and Mammoth grove, California; May 15–17. Var. PUBESCENS. Corte Madera, April 16. In this variety the peduncles are sometimes naked, and sometimes (even on the same specimen) furnished with a sessile, unifoliolate, or pinnately 2–7-foliolate bract. The whole plant is conspicuously pubescent.

HOSACKIA GRANDIFLORA, *Benth. in Bot. Reg. sub. t.* 1257; *Torr. & Gray, Fl.* 1, *p.* 323. Hill-sides, mouth of the Yuba, California; May 21. The bract is occasionally trifoliolate, and not unfrequently it is wanting altogether, or only rudimentary.

HOSACKIA PUBERULA, *Benth. Pl. Hartw., p.* 305; *Gray, Pl. Wright.* 1, *p.* 50. On Williams' River of the Colorado, western Mew Mexico, February 11.

HOSACKIA (EUHOSACKIA) INCANA (sp. nov.): perennis, undique et mollissime cano-villosa; caule erecto simplici; foliolis 11–13 ovatis acutiusculis; stipulis ovatis folioformibus; pedunculis folio multo brevioribus; umbellis 6–9-floris; bractea 5-foliolata; floribus pedicellatis; calycis dentibus subulato-lanceolatis tubo duplo brevioribus. (Tab. IV.) Dry hills, near South Yuba, California; May 23. Plant 6–10 inches high, densely clothed with soft greyish-white villous pubescence. Stem rather stout, leafy. Leaflets nearly half an inch long, mostly opposite, varying from broadly to narrowly ovate. Stipules about two-thirds the size of the leaflets, and resembling them in form. Peduncles (floriferous) half an inch or more in length. Flowers as large as in H. bicolor, apparently purple, mixed with yellow; the pedicels about one-third the length of the calyx. Pods not seen. Allied to H. stipularis, but abundantly distinct.

HOSACKIA PARVIFLORA, *Benth. in Bot. Reg. sub t.* 1257; *Torr. & Gray, Fl.* 1, *p.* 326. Napa Valley, April 25. Hills near Punta de los Reyes, and Tomales bay, April 17–19. H. microphylla and H. nudiflora of Nuttall seem to be only reduced forms of this species.

HOSACKIA STRIGOSA, *Nutt. in Torr. & Gray, Pl.* 1, *p.* 326. Cocomungo, March 26. We think that H. rubella, *Nutt.*, should be united to this species.

HOSACKIA SUBPINNATA, *Torr. & Gray, l. c.* Lotus subpinnatus, *Lagas. Gen. and Sp. p.* 33; *Hook. & Arn. Bot. Beech., p.* 17, *t.* 8. Corte Madera, April 10; hill-sides, Martinez, California; April 23.

HOSACKIA PURSHIANA, *Benth. l. c.; Torr. & Gray, l. c.* Lotus sericeus, *Pursh, Fl.* 2, *p.* 489. Low ravines, Grass valley, May 19. The four remaining species of the section Psycopsis of Nuttall (*in Torr. & Gray, Fl. l. c.*) are probably only forms of H. Purshiana.

HOSACKIA CYTISOIDES, *Benth. l. c.; Torr. & Gray, l. c.* Near San Francisco. Bracts mostly unifoliolate.

ROBINIA NEO-MEXICANA, *Gray, Pl. Thurb., p.* 314. Mountain arroyos, near San Antonita, New Mexico; October. In fruit.

GLYCYRRHIZA LEPIDOTA, *Nutt. Gen.* 2, *p.* 106. Sand banks of the Canadian, near the Shawnee villages; August. With ripe fruit.

INDIGOFERA LEPTOSEPALA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 298. With the preceding, and at Upper Crosstimbers, Indian Territory; August.

PHACA DENSIFOLIA, *Smith in Rees Cycl.; Torr. & Gray, Fl.* 1. *p.* 344 & 693; *Hook. Ic. t.* 283. P. Nuttallii, *T. & Gr. l. c.* Cocomungo, California; March 18. Legumes an inch and a half long, and more than three-fourths of an inch broad. Seeds numerous, not half the size of a pepper-corn. Our plant differs somewhat from Douglas's, as figured by Hooker in his Icones, especially in being smoother and the flowers larger, as well as in the larger calyx-teeth; but it is undoubtedly the same.

ASTRAGALUS DIDYMOCARPUS, *Hook. & Arn. Bot. Beech., p.* 334, *t.* 81; *Torr. & Gray, Fl.* 1, *p.* 693. Fields near Benicia, and Corte Madera; April 10–23. The specimens are much smaller than those collected by Douglas, Mr. Rich, and Dr. Parry. The legumes are scarcely three lines long, and of about the same breadth. When young they are villous, but nearly glabrous (though strongly rugose) when old. The leaves vary in breadth from half a line to two lines or more. We have little doubt that A. nigrescens and A. Catalinensis, *Nutt.* (*Pl. Gamb.*,) are varieties of this species.

ASTRAGALUS MISSOURIENSIS, *Nutt. Gen.* 2, *p.* 99; *Torr. & Gray, Fl.* 1, *p.* 331, *excl. syn. Pursh.* Gravelly hills, New Mexico, and on Williams' fork of the Colorado, February 6.

ASTRAGALUS FRÉMONTII (sp. nov.): molliter strigoso-cinerea; radice perenni; caulibus adscendentibus (10 poll. longis) crassiusculis; foliolis 9–21 ovalibus vel rotundatis retusis; stipulis triangulatis basi tantum petioli adnatis; pedunculis folium æquantibus, floribus laxiuscule spicatis patentibus subsessilibus; calycis dentibus subulatis tubo campanulato brevioribus; "corolla purpurea;" leguminibus immaturis membranaceis inflatis ovatis acuminatis bilocellatis polyspermis estipitatis. Banks of the Rio Virgin; May 3, 1844, Frémont. Var. caule breviori (2–3-pollicari); floribus majoribus; calyce magis cylindraceo et nigro-hirsuto. On the Mohave creek; March 3. An early state, only in flower, apparently of the same species as that gathered in the same region by Colonel Frémont. Leaflets 3–6 lines long. Flowers half an inch long; the calyx 3 lines long; the corolla apparently white, or whitish; all the petals tipped with deep violet purple. The half-grown pods of Frémont's specimens are over half an inch in length, nearly glabrous, very thin, and completely bilocellate.—*Gray, Mss.*

ASTRAGALUS HUMISTRATUS, *Gray, Pl. Wright.* 5, *p.* 45. Arroyos, near San Antonita, New Mexico; October. In fruit.

ASTRAGALUS MOLLISSIMUS, *Torr. in Ann. Lyc., New York,* 2, *p.* 178; *Gray, Pl. Wright.* 1, *p.* 53. Rocky ridges of the False Washita, August; and plains of the Upper Canadian, September. In flower.

ASTRAGALUS DIPHYSUS, *Gray, Pl. Fendl., p.* 34. Sandy places, near Albuquerque; October. In fruit.

ASTRAGALUS (PHACA) LONCHOCARPUS. Phaca macrocarpa, *Gray, Pl. Fendl., p.* 36. Bluffs and rocky places, on the Llano Estacado; September. The few specimens of this interesting plant bear only old and dehiscent pods, which are shorter than in Fendler specimens, and are follicular, opening as they do only by the ventral suture, and at length spreading out into a perfectly plane lamina. The leaflets are nearly all wanting, and the filiform naked petioles are rather persistent. The root is perennial. The name has to be changed, on account of the Astragalus macrocarpus of De Candolle.

OXYTROPIS URALENSIS, *DC. Prod.* 2, *p.* 276; *Hook. Fl. Bor.-Am.* 1, *p.* 145. Sandia mountains, New Mexico; October. In flower and fruit.

OXYTROPIS LAMBERTI, *Pursh Fl.* 2, *p.* 740. Rocky hills, of the Upper Canadian; September. Narrow-leaved and loosely-flowered forms. Pods slender and very minutely silky-puberulent; in one specimen of which the flowers are unknown, shorter and thicker, and strigose-hirsute.

OXYTROPIS SERICEA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 339. Bluffs and rocky places, on the Llano Estacado; September. There is scarce a doubt that this passes into O. Lamberti.

KENTROPHYTA MONTANA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 353. Inscription Rock, New Mexico;

November 18, (in fruit.) K. viridis is hardly a distinct species, and the genus itself might be reduced to a section of Astragalus.

LUPINUS SPARSIFLORUS, *Benth. Pl. Hartw.*, *p.* 303. Gravelly hills, on the Colorado, western New Mexico, February 26. A form with less hirsute leaves. Also a larger form, February 17.

LUPINUS NANUS, *Dougl.; Benth. in Hort. Trans.*, *p.* 459, *t.* 14, *f.* 2. Corte Madera, California; April 12–15. Some of the specimens are a foot or more in height. Those with broader eaflets accord with "L. nanus var. latifolius," *Benth.* in Herb. Coulter. The flowers are sometimes white.

LUPINUS DENSIFLORUS, *Benth. in Hort. Trans. n. ser.* 1, *p.* 409. L. Menziesii, *Agardh, Syn. Lup.*, *p.* 2. Woods and shady places, Knight's Ferry, on the Stanislaus river; May 7. Mr. Bentham (in *Pl. Hartweg p.* 303) points out that Agardh has founded his L. Menziesii upon the Douglasian plant, which he had described as L. densiflorus. All confusion about the synonymy may be avoided, however, for the two species, L. densiflorus and L. Menziesii, *Ag.*, cannot be kept distinct. Both have white flowers, (Agardh wrongly attributes yellow corollas to his L. Menziesii, but his guess from the appearance in dried specimens is not correct in this, nor in some other instances;) and the longer bracts and very villous calyxes of Agardh's L. densiflorus are evidently not available for a specific distinction. Dr. Bigelow's specimens, however, corresponds in this respect with L. Menziesii.

LUPINUS BICOLOR, *Lindl. Bot. Reg. t.* 1109; *Agardh, l. c. p.* 14. L. micranthus, *Dougl. in Bot. Reg. t.* 1251; *Torr. & Gray, l. c.* Wet places, near San Francisco, April 8. Plains, near San Gabriel; March 23.

LUPINUS LEPTOPHYLLUS, *Benth. in Hort. Trans. l. c. t.* 14, *f.* 2; *Torr. & Gray, l. c.* Hills and rocky places, Knight's Ferry, Stanislaus river; May 7.

LUPINUS LATIFOLIUS, *Agardh, l. c.* L. cytisoides, *Agardh, l. c.; Torr. & Gray, l. c.* Corte Madera, April 12; and hill-sides, Martinez, California; April 23. L. cytisoides was supposed by Agardh to have yellow flowers, but he saw only dried specimens, and was very probably mistaken.

LUPINUS RIVULARIS, *Lindl. Bot. Reg. t.* 1595; *Torr. & Gray, Fl.* 1, *p.* 377. Plains, near San Gabriel, March 23. Rather more silky than the ordinary state of the plant. Except in the entire calyx, it scarcely differs from L. Douglasii.

LUPINUS LAXIFLORUS, *Dougl. in Bot. Reg. t.* 1140; *Torr. & Gray, l. c.* Hill-sides, Stanislaus river, near Carson's, May 14. We are doubtful about our determination of this plant, as the calyx is not very decidedly gibbous.

LUPINUS DECUMBENS, *Torr.* var. ARGOPHYLLUS, *Gray, Pl. Fendl. p.* 37. Gravelly hills, near San Antonita, New Mexico; October. L. laxiflorus, Dougl., probably passes into this species.

LUPINUS ALBIFRONS, *Benth. in Hort. Trans.* 1, *c. p.* 410; *Lindl. Bot. Reg. t.* 1642; *Torr. & Gray, l. c.* Sand hills, on the sea-shore; Punta de los Reyes; and near San Francisco. April 3–17. A fine shrubby species.

LUPINUS ORNATUS, *Dougl. in Bot. Reg. t.* 1216; *Agardh, l. c. p.* 28; *Torr. & Gray, Fl.* 1, *p.* 378. Butte mountains, California; May 25.

LUPINUS MACROCARPUS, *Hook. & Arn. Bot. Beech.*, *p.* 138. On sand hills, near the sea; Punta de los Reyes, California; April 17. This species was discovered many years ago by Menzies, and seems not to have been found again till Dr. Bigelow collected it in Whipple's expedition. It resembles L. arboreus (which Dr. Parry obtained near San Diego) in its shrubby stem and large yellow flowers, but that species is minutely pubescent; this is very hirsute, and the leaves are silky underneath. The petioles of both are shorter than the leaflets, and in our specimens of L. macrocarpus the flowers are decidedly verticillate. We have not seen the pods.

THERMOPSIS MACROPHYLLA, *Hook. & Arn. Bot. Beech.*, *p.* 329; *Torr. & Gray, Fl.* 1, *p.* 388. L. montana, *Nutt. in Torr. & Gray, Fl. l. c.* Corte Madera, April 15. Leaflets often broadly obovate. Nuttall's T. montana can hardly be considered as more than a smoother form of this plant, with usually narrower leaves. We have specimens that are intermediate between the two.

Sophora speciosa, *Benth. in Gray, Pl. Lindh.* 3, *p.* 178. Dermatophyllum speciosum, *Scheele in Linnæa*, 21, *p.* 459. Cactus Pass and White Cliff creek, New Mexico, January 29.

Hedysarum boreale, *Nutt. Gen.* 2, *p.* 110. With the preceding; in flower and fruit.

Desmodium pauciflorum, *DC. Prod.* 2, *p.* 230. Creeks, on the Canadian river; August.

Desmodium cuspidatum, *Torr. & Gray, Fl.* 1, *p.* 360. Near Shawnee town; August.

Desmodium Canadense, *DC.; Torr. & Gray, l. c.* Wet places, on the Canadian; September. In fruit.

Desmodium paniculatum, *DC.; Torr. & Gray, l. c.* Sandy soil, on the Canadian; September.

Lespedeza violacea, *Pers.* On the Canadian; August.

Lespedeza capitata, *Michx.* Near Beavertown; August.

Cercis occidentalis, *Torr. in Gray, Pl. Lindh.* 2, *p.* 177. C. Siliquastrum, var. *Benth. Pl. Hartw.*, *p.* 307. Hill-sides, Robinson's Ferry, Stanislaus river; May 14; with immature fruit. This species has a very extensive range, being found from the upper Sacramento, northern California, to the high lands near Saltillo, Mexico.

Olneya Tesota, *Gray, Pl. Thurb.*, *p.* 328. Arroyos, near Williams' river of the Colorado, western New Mexico; February 6. The specimens are in fruit only. Some of them are destitute of prickles.

Parkinsonia microphylla, *Torr. Bot. of Mex. Boundary Survey, ined.* Banks of the Colorado, and on Williams' river; February 12–22; in fruit. A very distinct species with minute roundish leaflets.

Cercidium floridum, *Benth. in Gray, Pl. Wright.* 1, *p.* 58. In arroyos, near the Colorado. February 11; in fruit. This is the *Green Acacia* of Major Emory's report. It is a common tree on the Gila; attaining the height of 25 or 30 feet.

Cassia Rœmeriana, *Scheele in Linnæa*, 21, *p.* 458. Hurrah creek, New Mexico; September. In fruit.

Hoffmanseggia Jamesii, *Torr. & Gray, Fl.* 1, *p.* 393; *Torr. in Marcy's Rep. t.* 4. Prairies of the Canadian; September.

Hoffmanseggia stricta, *Benth. Var.* demissa, *Gray, Pl. Wright.* 1, *p.* 56. Dogtown praries, on the Llano Estacado; September.

Hoffmanseggia drepanocarpa, *Gray, Pl. Wright.* 1, *p.* 58. Plains, near Hurrah creek, New Mexico; September. In fruit.

Strombocarpa pubescens, *Gray, Pl. Wright.* 1, *p.* 60. Prosopis (Strombocarpa) pubescens, *Benth. in Hook. Lond. Jour. Bot.* 5, *p.* 82. P. (Strombocarpa) Emoryi, *Torr. in Emory's Rep.*, *p.* 139. Low sandy shore of the Colorado. Western New Mexico, (in fruit.) Prosopis odorata, *Torr. in Frém. Rep.*, *p.* 313, *t.* 1, is a var. of P. glandulosa, (in flower only,) with the pods of Strombocarpa pubescens. The error arose from the mixing of specimens in Frémont's collections.

Algarobia glandulosa, *Torr. & Gray, Fl.* 1, *p.* 399. Plains, on the Canadian; September.

Schrankia uncinata, *Willd.; Torr. & Gray, Fl.* 1, *p.* 400. Prairies, near Deer creek, Indian Territory; August.

Desmanthus brachylobus, *Benth. in Hook Journ. Bot.* Sand banks of the Canadian; August.

Calliandra humilis, *Benth. in Lond. Journ. Bot.* 5, *p.* 103; *Gray, Pl. Wright.* 2, *p.* 53. C. herbacea, *Englm.* Gravelly hills, near Santa Antonita, New Mexico; October. In fruit.

ROSACEÆ.

Prunus subcordata, *Benth. Pl. Hartw.*, *p.* 308. Hills, Sonora, May 9; near Duffield's Ranch, Sierra Nevada, May 11, and hill-sides, near Middle Yuba, California; May 23. A shrub 2–6 feet high. Fruit small, with a thin pulp. The leaves are sometimes pubescent underneath.

Prunus Americana, *Marsh. Ait.; Torr. & Gray, Fl.* 1, *p.* 407. Banks of Bogg creek, near Shawneetown, Indian Territory; August. In fruit.

Prunus Chicasa, *Michx. Fl.* 1, *p.* 284. Banks of the Canadian, near Shawneetown; August. With ripe fruit.

Prunus gracilis, *Engelm. & Gray, Pl. Lindh.* 1, *p.* 35. Prairies, Gains' creek, Indian Territory; August. In fruit. Cultivated under the name of Prairie Cherry. This appears to belong to the *Microcerasus* group.

Cerasus Virginiana, DC. Banks of the Pecos, and in cañons of the Llano Estacado; September. Sandia mountains; October. In fruit.

Cerasus demissa, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 411. Deep ravines, Sonora, California, May 9; and Duffield's Ranch, Sierra Nevada; May 12.

Cerasus emarginata, *Dougl. in Hook. Fl. Bor.-Amer.* 1, *p.* 169; *Torr. & Gray, Fl.* 1, *p.* 410. Hill sides, near Downieville, California; May 21. A small shrub, with numerous slender branches. Flowers in short corymbose racemes. Leaves ¾ of an inch to an inch and a half long, entire at the summit. Teeth of the calyx obtuse and reflexed.

Cerasus minutiflora, *Engelm. in Gray, Plant. Lindh.* 2, *p.* 185, *sub Pruno; Gray, Pl. Wright.* 2, *p.* 68. Williams' fork of the Colorado, Western New Mexico. Fruit only.

Cerasus ilicifolia, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 411; *& Sylv.* 2, *p.* 16, *t.* 47; *Hook. & Arn. Bot. Beechey, p.* 340, *t.* 83. Topographical Hill, near Williams' fork of the Colorado. With leaves only.

Nuttallia cerasiformis, *Torr. & Gray, in Hook. & Arn. Bot. Beechey, p.* 336, *t.* 82; *& Fl.* 1, *p.* 413. Mountains, near Oakland; April 5, (in flower and young fruit,) and hill-sides, Napa valley, California; April 27, (with mature fruit.)

Spiræa opulifolia, *Linn. Sp.* 1, *p.* 489; *Torr. & Gray, Fl.* 1, *p.* 413. Arroyos, in the Sandia mountains, New Mexico, October. Banks of streams and hill-sides, Napa valley, etc., California; April 27.

Spiræa ariæfolia, *Smith in Rees, Cycl.; Torr. & Gray, Fl.* 1, *p.* 416. Banks of streams, Sonoma, California; May 3.

Spiræa cæspitosa, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 418; *Gray, Pl. Fendl., p.* 40. Rocky places, Pass of Mt. Hope, Western New Mexico; January 23. The wood of the stem has no annual rings, even when several years old, and the medullary rays are as wide as the woody wedges.

Spiræa Millefolium (sp. nov.): lanoso-tomentosa; foliis circumscriptione oblongo-lanceolatis pinnatis multijugis, pinnis pinnatisectis partitisve oblongo-linearibus cum foliolis minutissimis oblongis confertissimis; floribus racemoso-paniculatis. (Tab. V.) Low hills and valleys, near Williams' mountain; January 5. A shrub, apparently 1–2 feet high. Leaves crowded on short branches or spurs, scarcely an inch long; pinnæ oblong-linear, in 20 or more pairs; the upper ones sometimes confluent; leaflets very numerous, about one-fourth of a line long, densely tomentose, and of a somewhat fleshy texture. Stipules linear, minute, deciduous. Racemes in a long and rather loose terminal panicle. Calyx turbinate; the teeth acute, erect, rather longer than the tube. Petals orbicular-obovate, longer than the calyx. Stamens about 70; the filaments distinct at the base, inserted into the margin of a disk, which is wholly adnate to the tube of the calyx. Ovaries 5, distinct, at first woolly; styles filiform; stigmas somewhat capitate. Ovules 8–10, pendulous from the upper part of the ovary, narrowly oblong. Mature carpels nearly glabrous, erect, 2-valved to the base. All the mature seeds had fallen, but the immature ones were somewhat attenuated at each end. Although so very remarkable, this appears to be a genuine Spiræa, and to resemble more the Euspiræa than any other of the admitted sections of the genus. The leaflets are almost as small and crowded as in Chamæbatia. The specimens collected by Dr. Bigelow seem to have the persistent inflorescence and fruit of the preceding autumn, and the young leaves of the new year. Many of the flowers exhibited the withered petals, and there were a few imperfect undeveloped buds.

Cercocarpus parvifolius, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 427; *Gray, Pl. Fendl., p.* 41; *Hook. Ic. Pl. t.* 323. Hills on the Llano Estacado; also sandy hills, Cahon Pass and Cocomungo, April 16–17; hills and ravines, Sonora, California; May 9. A shrub about 10 feet high. C. betulaefolius seems to pass into this species.

Chamæbatia foliolosa, *Benth. Pl. Hartw. p.* 308; *Torr. Pl. Frêmont., p.* 11, *t.* 6. Hill-sides and ravines, Sonora; May 9.

Cowania Mexicana, *Don in Linn. Trans.* 14, *p.* 574, *t.* 22; *Gray, Pl. Wright.* 2, *p.* 55. Mountains near the Zuni river. In leaf only.

Cowania Stansburiana, *Torr. in Stansb. Rep., p.* 386, *t.* 3. Ojo Piscado; November 19. San Francisco mountain, and Lithodendron creek, New Mexico; December. Although very near C. Mexicana it seems to retain its characters.

Acæna trifida, *Ruiz & Pav. Fl. Peruv.* 1, *p.* 67, *t.* 104. A pinnatifida, *Hook. & Arn. Bot. Beechey, p.* 339; *Torr. & Gray, Fl.* 1, *p.* 430, non *Ruiz & Pav.* San Geronimo Ranch; April 12.

Adenostoma fasciculata, *Hook. & Arn. Bot. Beechey, p.* 139 & 338, *t.* 30; *Torr. & Gray, Fl.* 1, *p.* 430. Sandy hills near Cajon Pass, March 16, (with the fruit of the preceding year.) Hill-sides, near Ion valley; May 18.

Alchemilla arvensis, *Scop. Fl. Carn.* 1, *p.* 115; *Torr. & Gray, Fl.* 1, *p.* 432. A. occidentalis and A. cuneifolia, *Nutt. in Torr. & Gray, Fl. l. c.* Hill-sides, Benicia, April 24. Low places near San Francisco, April 8. We find the characters of this species to be quite variable, so as to include the two species of Nuttall.

Fallugia paradoxa, *Torr. in Emory's Rep.* 2. Cañons of the Pecos, New Mexico; September.

Horkelia capitata, *Lindl. Bot. Reg. sub fol.* 1997; *Torr. & Gray, Fl.* 1, *p.* 434. San Gabriel, California; March 21. In Dr. Bigelow's specimens, as also in those collected at Los Angeles by Mr. Wallace, the petals are quite as long as the calyx. Agrees pretty well with our Douglasian specimen, except that the cymes are not capitate; but in most of the species of this genus the inflorescence is at first dense, and unfolds with age.

Horkelia fusca, *Lindl. Bot. Reg. t.* 1997. Var. tenuiloba: canescenti-villoso; foliolis 25–30, latissime-cuneatis profunde-palmitifidis; laciniis anguste-linearibus; cymis laxiusculis; bracteolis calycis dentibus subæqualibus; petalis cuneatis, apice bilobis. Laguna of Santa Rosa creek, California; May 1. Radical leaves 4–6 inches long, mostly villous with greyish hairs; leaflets less than half an inch long, palmately 5–7-cleft; the segments scarcely half a line wide; cauline leaves with a much smaller number of leaflets, with 3–4 segments. Stem about a foot high. Cyme somewhat open when the inflorescence is fully developed. Flowers about as large as in H. parviflora. Proper segments of the calyx triangular-lanceolate; the bracteoles narrowly lanceolate. Petals white, narrowly cuneiform, deeply notched at the summit.

Horkelia tridentata (sp. nov.): subsericeo-villosa; caulibus patenti-diffusis; foliolis 7–11 oblongo vel obovato-cuneatis apice plerumque tridentatis; stipulis profunde laciniatis; cymis densifloris; bracteolis calycis segmentis brevioribus et angustioribus; petalis obovato-spathulatis. (Tab. VI.) Wet ravines, Duffield's Ranch, Sierra Nevada; May 10; and hill-sides, Mammoth Grove, California; May 15. A span or more in height. Leaflets of the radical leaves 9–11, about half an inch long, almost uniformly 3-toothed at the apex, the intermediate tooth often smaller, otherwise entire; those of the cauline leaves (5–7) narrower. Petals at first narrowly spatulate, but broader when fully expanded. Somewhat resembling H. parviflora; the flowers being quite as small as in that species.

Potentilla Pennsylvanica, var. Hippiana, *Torr. & Gray, Fl.* 1, *p.* 438. Sandia mountains, New Mexico; October; in fruit. Some of the specimens nearly accord with P. diffusa, *Gray, Pl. Fendl. p.* 41, which Prof. Lehmann, the learned monographer of the genus, has no doubt correctly arranged as a variety of his P. Hippiana, viewed by him as distinct from P. Pennsylvanica.

Potentilla Anserina, *Linn. Sp.* 1, *p.* 495; *Torr. & Gray, Fl.* 1, *p.* 444. Wet places, San Domingo, New Mexico; October. Near San Francisco, California; April 3.

Potentilla rivalis, *Nutt. in Torr. & Gray, Fl. l. c.* Wet places near San Francisco, April 8.

Potentilla glandulosa, *Lindl. Bot. Reg. t.* 1583; *Torr. & Gray, Fl.* 1, *p.* 446. Mountains near Oakland, California; April 4.

Fragaria vesca, *Linn.; Torr. & Gray, Fl.* 1, *p.* 448. San Antonita, New Mexico, October. Ravines on the Yuba, near Downieville, May 22, and mountains near Oakland, California; April 5.

Fragaria Chilensis, *Ehrh.; Torr. & Gray, l. c.* Near San Francisco; April 3.

Rubus Nutkanus, *Moçino; Lindl. Bot. Reg. t.* 1368; *Torr. & Gray, Fl.* 1, *p.* 450. Corte Madera, California, April 10.

Rubus vitifolius, *Cham. & Schlecht. in Linnœa*, 2, *p.* 10? Near San Francisco; April 3. Stems long and apparently prostrate. Leaves (of flowering specimens) about an inch and a half in length and breadth, strongly 3-lobed, a little pubescent on both surfaces when young. Flowers smaller than the species is described to have. Sepals ovate-lanceolate, with a long subulate (not foliaceous) point. Petals white, a little longer than the calyx.

Rubus leucodermis, *Dougl.*; *Torr. & Gray, Fl.* 1, *p.* 454? Leroux's spring, foot of San Francisco mountain, New Mexico; December. Prickles numerous, slender, short and somewhat recurved. Leaves mostly pinnately 5-foliolate, very white underneath, much smaller than usual. Peduncles 5–6-flowered. The specimens are imperfect, the plant having been gathered late in the season.

Rubus ursinus, *Cham. & Schlecht. in Linnœa*, 2, *p.* 11; *Torr. & Gray, l. c.* R. Menziesii, *Hook. Fl. Bor.–Am.* 1 *p.* 141; *Hook. & Arn. Bot. Beech. p.* 140. Ravines and low grounds near Punta de los Reyes; April 17. A showy species, with large red flowers. The obovate petals are 7 or 8 lines long, much larger than they are said to be by Chamisso and Schlecthendal, who do not mention the color, and whose description of the species applies better to what we take for a state of R. macropetalus than to this plant.

Rubus macropetalus, *Dougl. in Hook. Fl. Bor.–Amer.* 1, *p.* 178, *t.* 59; *Torr. & Gray, l. c.* Cocomungo, California; March 18. The main stems are often prostrate, throwing up short erect branches. The leaves are mostly trifoliolate, except the uppermost ones, which are sometimes simple and 3-lobed. All the specimens seem to have perfect flowers.

Rubus trivialis, *Michx. Fl.* 1, *p.* 296. Low places near Mark West's creek, California; April 30. Petals elliptical-lanceolate, nearly twice the length of the sepals. Leaves all trifoliolate; leaflets rhombic-oblong. Perhaps only a state of R. macropetalus.

Rosa foliolosa, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 460. Upper Canadian river, and in the Sandia mountains; September—October. In fruit.

Rosa gymnocarpa, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 461. Near Bolinas, April 19; wet ravines, Grass valley, May 20, (in flower); also mountains near Oakland; April 5, (with the fruit of the preceding season). A very neat slender species. The leaflets vary from less than half an inch to three-fourths of an inch long. The flowers are scarcely an inch in diameter.

Rosa blanda, *Ait. Kew.* (*ed.* 1,) *p.* 202; *Torr. & Gray, Fl.* 1, *p.* 459. R. fraxinifolia, *Bork.; Torr. & Gray, l. c.* R. Californica, *Cham. & Schlecht. in Linnœa*, 2, *p.* 35. R. Woodsii, *Lindl.; Torr. & Gray, l. c.* Knight's ferry, Stanislaus river, May 7; Grass valley, May 19; low places, Mark West's creek, California; April 30 (with fruit of the preceding season.) This is a variable species, including, as we think, all those quoted above.

Pyrus rivularis, *Dougl. in Hook. Fl. Bor.–Amer.* 1. *p.* 203, *t.* 68; *Torr. & Gray, Fl.* 1, *p.* 71; *Nutt. Sylv.* 2. *p.* 22. *t.* 49. Santa Rosa creek, California; May 1.

Photinia arbutifolia, *Lindl. in Linn. Trans.* 13. *p.* 103, & *Bot. Reg. t.* 491; *Torr. & Gray, Fl.* 1, *p.* 473; Cajon Pass, March 16, (with unexpanded flowers.) Martinez, April 23, (young fruit;) Mark West's creek, California; and April 30 (mature fruit).

Amelanchier Canadensis, var. alnifolia, *Torr. & Gray, Fl.* 1, *p.* 473. Near Punta de los Reys, April 17. Hill sides, Nevada, May 20. Hills near Williams' fork of the Great Colorado. Another form of this species was found on the middle Yuba. It has ovate or obovate leaves, which are often nearly entire, or with only a few serratures at the summit. The racemes are 6–8-flowered, and the peduncles as well as the segments of the calyx are woolly.

Cratægus coccinea, *Linn.* Var. viridis, *Torr. & Gray, l. c.* In the Sandia mountains, New Mexico; October. With ripe fruit.

Cratægus subvillosa, *Schrad. Hort. Gœtt.* C. coccinea, *var.* mollis, *Torr. & Gray, l. c.* Shawnee villages on the Canadian River; August. In the great size of the fruit, no less than in the foliage, this differs from C. coccinea.

CALYCANTHACEÆ.

Calycanthus occidentalis, *Hook. & Arn. Bot. Beechey, p.* 340, *t.* 84; *Torr. & Gray, Fl.* 1, *p.* 476; *Bot. Mag. t.* 4808. Deep ravines, Napa Valley, California; (with old fruit).

LYTHRACEÆ.

Ammannia latifolia, *Linn.; Torr. & Gray, Fl.* 1, *p.* 480. Near Beavertown, on the Canadian River, in low places; August.

ONAGRACEÆ.

Epilobium coloratum, *Muhl.* Wet places, near San Domingo, New Mexico; October.

Epilobium palustre, *Linn.* In a spring, on the Upper Canadian; September.

Epilobium tetragonum, *Linn.; Hook. Fl. Bor.—Am.* 1, *p.* 206. Corte Madera, California; April 20. Near San Francisco Dr. Bigelow also gathered, early in April, specimens of an Epilobium, with purple flowers as large as those of E. montanum or E. parviflorum, but too young for satisfactory determination.

Epilobium minutum, *Lindl. in Hook. l. c.; Torr. & Gray, Fl.* 1, *p.* 490. Hill sides, Napa valley; April 24. Knight's Ferry on the Stanislaus river; May.

Œnothera jamesii, *Torr. & Gray, Fl.* 1, *p.* 493. Comanche Plains, etc., New Mexico; September.

Œnothera coronopifolia, *Torr. & Gray, l. c.* Laguna Blanca, New Mexico; September. The corolla is sulphur color in the dried specimens: it was probably white in the living plant.

Œnothera albicaulis, *Nutt.; Gray, Pl. Wright.* 1, *p.* 69. One of the cinereous varieties, with leaves toothed at the base. Sandy bottoms of the Upper Canadian; September.

Œnothera speciosa, *Nutt.; Torr. & Gray, l. c.* Near Shawneetown and Beaverstown, on the Canadian river; August.

Œnothera missouriensis, *Sims.* Naked prairies of the Upper Canadian. The smooth and broader-leaved form. Var. incana. False Washita and Comanche Plains; September.

Œnothera serrulata, *Nutt. Gen.* 1, *p.* 246. Walnut Creek, etc.; August.

Œnothera lepida, *Lindl. Bot. Reg. t.* 1849. Plains near Stockton and Knight's Ferry, California; May 7.

Œnothera viminea, *Dougl. in Bot. Mag. t.* 2873. Hill-sides and plains, Knight's Ferry; May 8. Var.? parviflora, *Hook. & Arn.* Napa valley, May 5.

Œnothera tenella, var. tenuifolia, *Lindl.; Hook. & Arn. Bot. Beech. p.* 342. Hill-sides, Knight's Ferry, California; May 7.*

Œnothera densiflora, *Lindl. Bot. Reg. t.* 1593. Knight's Ferry, Stanislaus river; in dry ravines and on plains; May 8.

Œnothera clavæformis, *Torr. in Frêm. 2d Rep. p.* 314. Mohave Creek; March 2. Rocky arroyos of the Colorado; Feb. 22. The petals barely equal the stamens, (2 or 3 lines long,) and the style is soon much exserted. The corolla would seem to be whitish; but specimens gathered at the foot of the Sierra Nevada, by Lieut. Beckwith, (Beckwith's Report, p. 115,) are plainly yellow-flowered. The following is a third and very striking species of the same group, (Chylismia of Nuttall,) connecting it with Sphærostigma.

* Œbiloba, *Durand, Pl. Pratten. Calif. in Jour. Acad. Philad.* 1855, (the same as Hartweg's, No. 1,728,) appears to be a well-marked species. The petals vary, however, in the degree in which they are obcordate or two-lobed. In specimens raised by Dr. Short, from seeds collected in California by Dr. Dayton, the petals ("delicate rose-color, changing to violet") are nearly two-cleft.—*Gray, Mss.*

ŒNOTHERA (CHYLISMIA) BREVIPES (sp. nov.): villoso-hirsuta vel glabra; caule simplici (3–9 pollicari) inferne foliato; foliis lyrato-pinnatisectis, segmentis denticulatis, lateralibus parvis irregularibus nunc obsoletis, terminali maximo ovato vel subcordato; petalis calyce staminibusque duplo longioribus, capsula longe lineari tubum calycis et pedicellum multoties excedente. Gravelly hills on and near the Colorado; February 17 and 20. We have seen an imperfect specimen of this plant in a small collection made on the Gila, etc., by A. B. Gray, Esq., surveyor, in the possession of Mr. George Thurber. The stem is pretty stout, much thicker than that of O. scapoidea and the nearly related O. clavæformis; and the flowers are very much larger, the light yellow petals being from half an inch to an inch in length; they are rounded, obovate, and entire. The pedicels are about as long as the bracts, varying from 1 to 5 lines in length, while the ovary is usually an inch long. The latter, like the limb of the calyx, is very villous in some specimens, and sparingly so or entirely glabrous in others. Ripe pods arcuate ascending, about an inch and a half long. Veins of the leaves often purplish beneath, as in O. clavæformis. The raceme is nodding at the undeveloped summit, and scorpioid, as in the related species.—*Gray, Mss.*

ŒNOTHERA OVATA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 507. San Francisco, and on mountains near Oakland; April 3 and 4.

ŒNOTHERA GRACILIFLORA, *Hook. & Arn. Bot. Beech., p.* 341; *Hook. Ic. t.* 338. San Gabriel, California; March 23.

ŒNOTHERA DENTATA, *Cav.?; Torr. & Gray, Fl.* 1, *p.* 510. Gravelly hills near the Great Colorado; February 17. Knight's ferry, on the Stanislaus; May; a much branched and larger flowered variety.

ŒNOTHERA STRIGULOSA, *Torr. & Gray, l. c.* Cocomungo; March 8, and San Francisco; April 8.

ŒNOTHERA CHEIRANTHIFOLIA, *Hornem.; Torr. & Gray, l. c.* San Francisco; April 8.

ŒNOTHERA VIRIDESCENS, *Hook. Fl. Bor.-Am.* 1, *p.* 214. Seashore at Punta de los Reyes, California; April 17.

GAYOPHYTUM NUTTALLII, *Torr. & Gray, Fl.* 1, *p.* 514. Hillsides on the Yuba, near Downieville; May 22.

EUCHARIDIUM CONCINNUM, *Fischer & Meyer; Lindl. Bot. Reg., t.* 1962. Bolinas bay, California; April 19. Also, a specimen collected by Dr. Andrews; the habitat not recorded. This plant rarely occurs in Californian collections.

CLARKIA ELEGANS, *Lindl. Bot. Reg., t.* 1575. Also, C. unguiculata, *Lindl.?* Hillsides, Knight's ferry; May 7–8.

LUDWIGIA NATANS, *Ell. Sk.* 1, *p.* 581. Beavertown on the Canadian in wet places; August.

STENOSIPHON VIRGATUS, *Spach. Monogr. Onagr., p.* 64. Rocky prairies on the Canadian; August.

GAURA PARVIFLORA, *Dougl. in Hook. Fl. Bor—.Am.* 1, *p.* 208. Sand banks of the Canadian; August.

GAURA BIENNIS, *Linn.* β. PITCHERI, *Torr. & Gray, Fl.* 1, *p.* 517. Near Beaverstown, Indian Territory; August. San Domingo; October.

GAURA VILLOSA, *Torr. in Ann. Lyc. New York,* 2, *p.* 200. Prairies and hills on the Upper Canadian; September.

GAURA COCCINEA, *Nutt. Gen.* 1, *p.* 249. Prairie hills on the Canadian; September.

GAURA HETERANDRA (sp. nov.): glabella, annua; caule ramoso; foliis membranaceis ovato-lanceolatis summis anguste lanceolatis acuminatis petiolatis; spicis paniculatis laxis; floribus tetrameris parvis, inferioribus folioso-bracteatis; tubo calycis infundibuliformi lobis dimidio brevioribus; petalis obovato-spathulatis conformibus; staminibus 8, alternis brevioribus fere anantheris, 4 longioribus antheris cordato-rotundis; stigmate integro; fructu brevissime pedicellato obovato gibboso 3-4-loculari. River banks, Mokelumne Hill, California; May 17. Stem a foot or more in height, erect, paniculately branched above; the branches, etc., slightly puberulent. Cauline leaves two inches in length, and with a slender petiole of half or two-thirds of an inch

in length, those of the branches smaller and narrower; all thin, entire, or obscurely repand, loosely feather-veined. Flowers apparently purple, small, the lobes of the calyx and the petals about two lines long. Stamens apparently not declined; the four longer ones equaling the petals, and with very short basi-fixed anthers; the alternate ones (opposite the petals) much shorter, and with the anthers abortive. Style long; stigma hemispherical, entire, or nearly so. Fruit globular-obovate, gibbous, obscurely ribbed, a line and a half long, indehiscent. This is the only Gaura yet known from California, and a very peculiar one, but apparently of this genus, notwithstanding the abortive shorter stamens and the short anthers of the others.

Hippuris vulgaris, *Linn. Spec.* 1, *p.* 4. Ponds near Tomales bay, California; April 19.

GROSSULACEÆ.

Ribes Californicum, *Hook. & Arn.*, R. Californicum, occidentale, and subvestitum, *Hook. & Arn. Bot. Beech.*, *p.* 346; *Torr. & Gray, Fl.* 1, *p.* 545, 548. Dr. Bigelow's specimens, with others, collated with those of Douglas, plainly show that the three above-mentioned nominal species must be reduced to one, which should stand next to R. Menziesii, (the anthers of which are slightly mucromate,) and for which the name of R. Californicum is to be preferred. The subaxillary spines are sometimes solitary, geminate and ternate on the same branch; the branches are setose or naked on otherwise similar plants; the foliage is either glabrous, glandular-pubescent beneath, or simply pubescent, and either moderately or deeply lobed and incised; the flowers in all are reddish or purple; the ovary, etc., more or less strongly glandular and setose, and with or without a soft or hirsute pubescence. R. Californicum was founded on a small-leaved and smaller-flowered state of the species. R. subvestitum on a larger-leaved and large-flowered form. Dr. Bigelow's collection comprises the following: 1. From rocky ravines, Cajon Pass; March 16: the R. subvestitum, *Hook. & Arn.*, except that the branchlets are not setose, and the pubescence of the leaves scarcely glandular.—2. Mammoth Grove, on the prostrate trunk of a huge Sequoia gigantea; May 11: similar to the preceding, but the leaves more cleft, and the calyx-tube more pubescent.—3. Mountains near San Gabriel; March 28: like No. 1, but more glabrous leaves, glandular-dotted beneath.—4. Duffield's ranch, Sierra Nevada, with young fruit, which is large, hairy, and prickly.—5. Grass valley; May 20, with young fruit: the same, with glabrous leaves.—6. Duffield's Ranch, on hillsides, and near San Francisco: forms with the foliage and calyx, etc., perfectly glabrous; the fruit glandular and prickly. This answers to R. occidentale, but the subaxillary spines are often in pairs, threes, or fives. It is the same as Hartweg's No. 1736.—*Gray, Mss.*

Ribes divaricatum, *Dougl. in Hort. Trans.* 7., *p.* 515; *Torr. & Gray, l. c.*; San Francisco; April 3. This accords entirely with the Californian plant of Douglas's collection, except that the racemes are 4–5-flowered. Nuttall's R. villosum is merely a pubescent form of it.

Ribes glutinosum, *Benth. in Hort. Trans. n. ser.* 1, *p.* 476; San Francisco; April 3. Duffield's Ranch; May 12. Also, at Mammoth Grove, on the prostrate trunk of a huge Sequoia, at the height of twenty feet from the ground.

Ribes malvaceum, *Smith; DC. Prod.* 3, *p.* 383; *Torr. & Gray, l. c.* Cajon Pass; March 16. San Francisco; April 28.

Ribes aureum, *Pursh, Fl.* 1, *p.* 164, Var. R. tenuiflorum, *Lindl. Bot. Reg.*, *t.* 1,274. Rocky hills on the upper Canadian river. Plains near San Gabriel, California; March 23, in flower.

Ribes leptanthum, *Gray, Pl. Fendl.*, *p.* 53. Laguna Blanca, New Mexico, in rocky places at the foot of mountains; September.

Ribes oxyacanthoides, *Linn.?* Rocky hills near San Domingo, New Mexico; October, without flowers or fruit.

CUCURBITACEÆ.

Melothria pendula, *Linn.* On the Canadian River and Deer creek; August.

CYCLANTHERA DISSECTA, *Arn. in Hook., Jour. Bot.* 3, *p.* 280. Banks of the False Washita; August.

CUCURBITA PERENNIS, *Gray, Pl. Lindh.* 2, *p.* 193. Cucumis perennis, *James.* Camanche plains, on the banks of streams; September.

LOASACEÆ.

EUCNIDE LOBATA, *Gray, Pl. Lindh.* 2, *p.* 192. Rocky ravines of the Colorado, near the confluence of Williams' River, in western New Mexico. The specimens were winter vestiges, with good fruit of the preceding season.

MENTZELIA ALBICAULIS, *Torr. & Gray, Fl.* 1, *p.* 534. Bartonia albicaulis, *Hook. Fl. Bor.-Amer.* 1, *p.* 222. Mohave creek, California; March 2.

MENTZELIA LINDLEYI, *Torr. & Gray, l. c.* Gravelly hills along the Great Colorado; February 20.

MENTZELIA OLIGOSPERMA, *Nutt. in Bot. Mag. t.* 1760. Rocky hills on the False Washita, etc.; August.

MENTZELIA (BARTONIA) NUDA, *Nutt.; Torr. & Gray, Fl.* 1, *p.* 534. On Elm creek and the False Washita; August. Denuded plains of the Upper Canadian; September.

MENTZELIA (BARTONIA) MULTIFLORA, *Nutt. Pl. Gamb. p.* 180; *Gray, Pl. Wright. p.* 74. Rocky cañons, from the Llano Estacado to Galisteo, New Mexico; October.

CRASSULACEÆ.

SEDUM WRIGHTII, *Gray, Pl. Wright.* 1, *p.* 76. Sandia mountains, New Mexico; October. A dwarf and condensed state.

SEDUM SPATHULIFOLIUM, *Hook. Fl. Bor.-Amer.* 1, p. 227; *Torr. & Gray, Fl.* 1, *p.* 559. Hill-sides and rocky places, Napa valley, California; May 5. Stems ascending, simple, or sparingly branched, throwing off from the base prostrate sterile runners or offsets, which bear a rosulate tuft of leaves at the extremity, and strike root.

ECHEVERIA LANCEOLATA, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 561. Rocks and hill-sides, Sonoma, and Knight's Ferry, Stanislaus river, California; May 3–9. The leaves vary in form, from lanceolate to obovate. The pedicels are from one-third to more than half the length of the flower.

SAXIFRAGACEÆ.

SAXIFRAGA VIRGINIENSIS, *Michx. Fl.* 1, *p.* 269; *Torr. & Gray, Fl.* 1, *p.* 571; *Benth. Pl. Hartw. p.* 311. Mountains near Oakland, California. The leaves are less toothed, and the petals broader than in the eastern plant, but in other respects there is little difference. Dr. Bigelow collected in Napa valley (May 5) an unusual state of this species, with large, thin, nearly entire glabrous leaves, and a very loose sparsely-flowered panicle; characters which may be owing to the plant having grown in a moist shady place.

SAXIFRAGA INTEGRIFOLIA, *Hook. Fl. Bor.-Amer.* 1, *p.* 249, *t.* 86: var. foliis oblongo-lanceolatis, basi angustatis; cymis in paniculam elongatam sub-contractam dispositis; floribus brevi-pedicellatis; calycis segmentis oblongis recurvis; petalis lineari—lanceolatis, obtusis. Swamps near Santa Rosa, California; May 3. Plant 24–30 inches high; leaves 2–3 inches long; corolla apparently white. This variety has a strong resemblance to S. Pennsylvanica. The panicle remains contracted even in fruit.

HEUCHERA MICRANTHA, *Dougl. in Bot. Reg. t.* 1302; *Torr. & Gray, Fl.* 1, *p.* 579. Rocky ravines, Yuba, near Downieville, May 22; and shady hill-sides, Napa valley, California; May 5. The solitary specimen from the latter locality is leafy to the summit, and more hairy than is usual in this species. This accords with Hartweg's No. 1742, but it can hardly be H. pilosissima of Fischer and Meyer.

Lithophragma heterophylla, *Hook. & Arn. Bot. Beech. p.* 346; *Torr. & Gray, Fl.* 1, *p.* 585. Hill-sides, near Napa, California; April 26. A smaller form occurs on the mountains near Oakland.

Tellima grandiflora, *Dougl.; Lindl. Bot. Reg. t.* 1178; *Torr. & Gray, Fl.* 1, *p.* 583. Head of Tomales bay, and Redwoods, California; April 12—17. In the dried specimens from Tomales bay the petals are bright crimson. We have not received this plant before, except from Oregon.

Philadelphus Californicus, *Benth. Pl. Hartw., p.* 309. Ravines, Mokelumne Hill, May 17, (flowers unexpanded.) Frémont collected fine specimens of this plant on the rocky banks of the American river; June 14, 1846. It grows from 8 to 12 feet high. We fear it is scarcely distinct from P. Lewisii.

Philadelphus Lewisii, *Pursh, Fl.* 1, *p.* 29. Var. parvifolius: foliis ovato-oblongis utrinque acutis remote denticulatis margine ciliolatis cæteris glabriusculis; thyrso pedunculato, multifloro. Hill-sides, Duffield's Ranch, Sierra Nevada; May 12. The specimens are without flowers, but bear the fruit of the last season. It is therefore uncertain whether the inflorescence was naked, as the leaves of the preceding year had fallen. The leaves are scarcely an inch long, and the thyrsus is 6–12-flowered.

Jamesia Americana, *Torr. & Gray, Fl.* 1, *p.* 593; *Gray, Pl. Fendl. p.* 55. Arroyos in the Sandia Mountains, New Mexico; October. In fruit.

Fendlera rupicola, *Engelm. & Gray, Pl. Wright.* 1, *p.* 77, *t.* 5. Cañons of the Pecos, New Mexico; September.

WHIPPLEA, Nov. Gen.

Flores hermaphroditi. Calyx 5–6- fidus, tubo brevissimo turbinato cum ovarii basi connato, segmentis oblongo-lanceolatis æstivatione valvatis? Petala 5–6, perigyna, rhomboideo-ovata, basi angusta subunguiculata, æstivatione imbricata? marginibus involutis, decidua. Stamina 10 vel 12, cum petalis inserta, iisdem opposita et alterna, ea sepalis anteposita breviora: filamenta subulata: antheræ didymæ, subintrorsæ, longitudinaliter dehiscentes. Ovarium quadriloculare, quadriovulatum: styli discreti, ovario subæquilongo, subulato-lineares, intus plani longitrorsum stigmatosi. Ovulum in quoque loculo solitarium, suspensum, anatropum. Capsula[1] 4–5-cocca, parva, basi calysis tubo accreta, coccis coriaceis; intus dehiscentibus. Semen pendulum. Embryo minutus, in apice albuminis, rectus; radicula supera. Suffrutex—Californicus, sarmentosus; foliis oppositis membranaceis deciduis ovatis trinervatis paucidentatis; stipulis nullis; pedunculis gracilibus terminalibus racemum parvum confertum gerentibus; floribus parvis albis.

Whipplea modesta. (Tab. VII.) Red-woods, California; April 12. A slender, nearly simple or moderately branching under-shrub, about a foot long, sparsely clothed with strigose scabrous hairs. Leaves on very short petioles, about an inch long, membranaceous, obtuse, 2–3-toothed on each margin, green on both sides, 3-nerved from the base, softly strigose-pubescent; the hairs of the upper surface arising from a slightly tuberculate base. Peduncles terminal, 1–2 inches long: raceme 6–12-flowered, the flowers mostly opposite; pedicels about 2 lines long, spreading. Calyx whitish, the tube pubescent; segments lanceolate, rather acute, one-nerved, erect. Petals exceeding the sepals, about a line and a half long, slightly imbricated, the margin involute in the bud. Stamens twice as many as the petals, (very rarely 4,) in a double series: filaments subulate, flat, inserted with the petals at the base of the free portion of the calyx: anthers didymous, the cells roundish, opening on the margin from the summit to the base; pollen extremely minute, globose. Ovary ovate-globose, the base adherent to the tube of the calyx; styles (rarely 3) linear, flat, slightly united at the base, the upper half stigmatose on the inside. Ovules large for the size of the ovary, suspended from the inner angle of the cell at the summit,

[1] From Dr. T. L. Andrews, lately of California, we have received, just in time for this publication, the Whipplea with nearly ripe fruit.

furnished with a small caruncle at the micropyle. Fruit subglobose, about a line and a half in diameter. There can be little doubt of the affinities of this interesting plant. Notwithstanding some of its anomalies, it must be referred to the suborder Hydrangeæ of Saxifragaceæ. In Eremosyne of Saxifrageæ proper the cells of the ovary are one ovuled; also in Aphanopetalum, and in the new genus Spiræanthemum[1] of the suborder Cunoniaceæ. The hairs, especially those of the leaves, exhibit the same muricate-scabrous appearance that occurs in those of Deutzia, Philadelphus, Fendlera, and other genera of Hydrangeæ. It is somewhat difficult to determine the æstivation of the petals of this genus, as the flower is open while the bud is yet very young; but in one or two instances they were slightly overlapping. We dedicate this new genus to the accomplished commander of the expedition.

UMBELLIFERÆ.

ERYNGIUM DIFFUSUM, *Torr. in Ann. Lyc. New York*, 2, *p.* 207, *& in Marcy's Report*, *t.* 6. Prairies on the False Washita; August. The root appears to be annual.

SANICULA BIPINNATA, *Hook. & Arn. Bot. Beechey*, *p*, 347; *Torr. & Gray*, *Fl.* 1, *p.* 603. Hill-sides, Martinez, California, April 23, (with mature fruit.) The heads or umbellets are about 3 lines in diameter, on long slender rays. Pedicels of the sterile flowers shorter than the fruit. Root fusiform.

SANICULA BIPINNATIFIDA, *Dougl. in Hook. Fl. Bor.–Amer.* 1, *p.* 258, *t.* 92; *Torr. & Gray*, *Fl. l. c.* Cocomungo, San Francisco and Benicia; March and April. This is rather a common plant in California and Oregon.

SANICULA TUBEROSA (sp. nov.): caule gracili e tubero globoso; foliis pinnatisectis, segmentis angustis pinnatifidis inciso serratis vel dentatis; foliolis involucralibus profunde trifidis, laciniis plerumque dentatis; floribus sterilibus longe pedicellatis; calycis tubo tuberculato. Hill-sides, Duffield's Ranch, Sierra Nevada; April—May. Tuber half an inch in diameter, fleshy and farinaceous. Stem (fructiferous) 12–14 inches high, moderately branching. The primary divisions of the leaves are rather ternate than pinnate. The secondary ones are pinnately and deeply cut, with pinnatifid or sometimes finely dissected segments. Umbels compound, or sometimes decompound; the rays seldom more than two, unequal. Heads nearly half an inch in diameter. Sterile flowers 15–20, on pedicels 3–4 lines long. Fertile flowers 1–5, sessile. Calyx-tube in fruit covered with conical obtuse tubercles, which are not at all hooked at the point. Teeth of the calyx lanceolate. Styles elongated, recurved. This remarkable species was first collected by Colonel Frémont in 1844 on the American river, and afterwards on the upper waters of the Sacramento, but without fruit. The specimens of Dr. Bigelow have the fruit not quite mature, but fully formed, and yet without any appearance of prickles; instead of which there are rather soft tubercles. In all the other North American species of Sanicula the calyx-tube, in its youngest state, shows the uncinate prickles distinctly. Our plant most resembles S. bipinnata, but is distinguished by its long-stalked sterile flowers and unarmed fruit.

SANICULA MENZIESII, *Hook. & Arn. Bot. Beech.*, *p.* 142 & 347; *Hook. Fl. Bor.–Amer.* 1, *p.* 258, *t.* 90; *Torr. & Gray*, *Fl. l. c.* Hill-sides, San Francisco and Martinez, April; in flower and fruit.

SANICULA LACINIATA, *Hook. & Arn. l. c.; Torr. & Gray*, *l. c.* β. nudicaulis, *Hook. & Arn. l. c.; Torr. & Gray*, *l. c.* Hill-sides, Napa valley, California; April 27, with flower and young fruit. S. nudicaulis can hardly be regarded as more than a variety of S. laciniata; the chief difference being the less finely cut leaves of the latter.

SANICULA ARCTOPOIDES, *Hook. & Arn. l. c.; Hook. Fl. Bor.–Amer.* 1, *p.* 258. *t.* 91; *Torr. & Gray*, *l. c.* San Francisco, April 3.

APIUM GRAVEOLENS, *Linn.; DC. Prodr.* 4, *p.* 101; *Hook. & Arn. Bot. Beechey*, *p.* 142. The

[1] Gray, Botany of the United States Exploring Expedition, 1, p. 666.

label of this plant got misplaced, but we suppose the specimens were collected near the coast. They agree with others found near San Luis Rey, California, by Dr. Parry.

Berula angustifolia, *Koch; Gray, Pl. Fendl. p.* 55, *and Pl. Wright.* 2, *p.* 65. In water, near San Domingo, New Mexico; October. In fruit.

Cymopterus montanus, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 624; *Gray, Pl. Fendl., p.* 56. William's river, New Mexico; January 26, (scarcely in full flower.) Called by the Mexicans *Gamote* or *Camote.* The root is about as thick as a man's thumb, and seems to be farinaceous.

Peucedanum leiocarpum, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 626. Seseli leiocarpum, *Hook. Fl. Bor.-Amer.* 1, *p.* 262, *t.* 93. Hill-sides, Napa, California, April 25; in flower. The segments of the leaves are broader than in the Oregon plant; so that we suspect P. latifolium may be only a variety of this species.

Peucedanum nudicaule, *Nutt. in Torr. & Gray, Fl. l. c.* Ferula Nuttallii, *DC. Prodr.* 4, *p.* 173. *β?* ellipticum, *Torr. & Gray, in Beckwith's Rep.* Hill-sides, Sonoma, May 3; (with flowers and immature fruit), and Feather river, near Marysville, California; with mature fruit. The fruit is so much longer and narrower in proportion than in the normal form of P. nudicuale that we would have described this plant as a distinct species, were there other marks of difference; which, however, we have not been able to find. Besides, in other species of this genus there is considerable variation in the form and size of the fruit.

Peucedanum tomentosum, *Benth. Pl. Hartw., p.* 312. Knight's Ferry, Stanislaus river, May 7; with immature fruit; and Corte Madera, California, on hills. We have a strong suspicion that this species, P. dasycarpon, macrocarpon, and fœniculaceum (at least the western plant) are not distinct. We have many intermediate forms that appear to connect them; but are unwilling, at present, to unite them.

Peucedanum dasycarpum, *Torr. & Gray, Fl.* 1, *p.* 628. Knight's Ferry, Stanislaus river, May 7; with immature fruit. Peduncles 15 inches long. Ultimate segments of the leaves narrowly linear. Fruit (not mature) elliptical-obovate, very woolly. Segments of the involucels lanceolate. Perhaps not sufficiently distinct from P. fœniculaceum. The number of North American species of this genus will doubtless be reduced when they are carefully studied with more ample materials than we now possess.

Peucedanum caruifolium, *Torr. & Gray, Fl. l. c.* Ferula caruifolia, *Hook. & Arn. Bot. Beech. p.* 348. Mark West's creek, Napa valley, and on hill-sides, near Sonoma, California, April—May. The specimens are much larger than the original ones of Douglas and Nuttall, being about a foot and a half high. This is pretty certainly P. marginatum, *Benth. Pl. Hartw. p.* 312, *No.* 1752; and we suspect that it is also P. abrotantifolium, *Nutt. Pl. Gambel.*

Peucedanum utriculatum, *Nutt. in Torr. & Gray, l. c.* Hill-sides, Martinez; mountains near Oakland; Mark West's creek, and Cocomungo, California; March—April.

Leptotænia? Californica, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 630. Hills, near Tokeloma creek, April 17, (with flowers and young fruit;) Napa valley, April 26, (with nearly ripe fruit.) This plant, which Nuttall referred with doubt to Leptotænia, and thought (as he had not seen the fruit) might perhaps be a species of Polytænia, does not accord entirely with either genus. From the former it differs in having emarginate petals with a long inflexed point, and 6 vittæ on the commissure, with numerous true vittæ on the back, and nearly obsolete ribs; the involucels also are wanting. From the latter it disagrees in the toothless calyx, as well as in wanting the involucels. The fruit is oval or elliptical, about 5 lines long, and the border is rather thin. Many of the flowers are abortive, and in some of the umbels all are so. The primary rays are about 3 inches long.

Heracleum lanatum, *DC. Prodr.* 4. *p.* 192. *Torr. & Gray, Fl.* 1, *p.* 632. H. Douglasii, *DC. l. c.* Corte Madera, California, April 10; in flower. Scarcely more pubescent than the eastern plant.

DAUCUS PUSILLUS, *Michx. Fl.* 1, *p.* 164; *Torr. & Gray, Fl.* 1, *p.* 636. Hill-sides, Napa, April 25. This plant has some reputation among the Mexicans as a remedy for the bite of venemous serpents; but its efficacy is very doubtful.

DAUCUS BRACHIATUS, *Sieb.; DC. Prodr.* 4, *p.* 514; *Gray, Bot. U. S. Expl. Exped.* 1, *p.* 711. Scandix glochidiata, *Labill. Pl. N. Holl.* 1, *p.* 75, *t.* 102. Caucalis microcarpa, *Hook. & Arn. Bot. Beech. p.* 348; *Torr. & Gray, Fl.* 1, *p.* 636. Hill-sides, Knight's ferry, Stanislaus, May 1, (in fruit.) A widely diffused plant, being found in Australia, New Zealand, Peru, Chili, many parts of Mexico, and California. It may have been brought to California by cattle. An original specimen of Labillardiere differs from our plant only in the rather denser prickles of the fruit. It is more nearly related to Caucalis than to Daucus, but does not accord wholly with either genus.

CHÆROPHYLLUM? CALIFORNICUM (sp. nov.): perenne, erectum, elatum, glaberrimum; foliis triternatisectis, lobis linearibus integris vel paucidentatis; involucro polyphyllo; calycis margine 5-dentato; fructibus oblongis utrinque obtusis, costis vix elevatis. Wet ravines, Knight's ferry, Stanislaus, May 8; in flower and fruit. Stem 3–4 feet high, nearly simple. Leaves (including the petioles) a foot in length; the primary divisions biternately or bipinnately divided; the segments either all (except the elongated terminal one) coarsely 2–3-toothed, or nearly entire and linear; uppermost leaves simply 3-parted with entire divisions. Umbels on very long peduncles, the primary one wholly female, 9–12-rayed. Involucre 9–12-leaved, scarcely one-fifth the length of the rays. Lateral umbels wholly male. Umbellets many-flowered, about an inch long. Involucels of numerous entire lanceolate leaves. Petals white, broadly oval, emarginate, with a small inflexed point. Calyx with 5 distinct acute teeth. Stylopodium broadly conical. Styles half the length of the ovary, recurved. Fruit about five lines long, often a little curved, or gibbous, laterally compressed: mericarps obscurely ribbed, with large single vittæ in the intervals and 4 in the commissure. Seed deeply furrowed on the face, but not involute, with an elevated central ridge; carpophore 2-cleft at the summit. We are by no means satisfied with our disposition of this plant. It rather falls into this genus than into any other known to us; yet it differs much in habit and in several characters from Chærophyllum.

OSMORHIZA BRACHYPODA, *Torr. in Durand's Plantæ Pratt.* (*Jour. Acad. Phil. n. ser.* 2, *p.* 79). Hill-sides, Yuba, Downieville, California; May 22. It was also found with mature fruit by Dr. Parry near Monterey, and by Mr. Pratten on Deer creek. The flowering specimens collected by Dr. Bigelow are only a foot high. Easily distinguished from O. brevistylis and O. longistylis by the very short pedicels of the fertile flowers and fruit, the minute stylopodium, and shorter trapezoidal segments of the leaves. In the short styles it is nearest O. brevistylis, but it is quite glabrous, and the fruit is much more hispid on the angles than in that species.

OSMORHIZA NUDA (n. sp.): stylis brevissimis; fructibus obtusis; involucris et involucellis nullis; pedicellis fructu longioribus. Shady woods, Napa valley, April 27. Plant about two feet high. Leaves on long petioles, which, as well as the lower part of the stem, are strigosely pubescent; segments broadly ovate, often deeply 3-lobed, coarsely dentate-serrate. Peduncles enlongated. Umbel about 4-rayed; umbellets 4–6-flowered. Flowers like those of O. brevistylis. Fruit (immature) very hispid, especially towards the base, crowned with a short conical stylopodium. This species is intermediate between Osmorhiza and Glycosma. In its bristly fruit it is like the former, and in the short stylopodium and styles, as well as in the entire absence of the involucres, it resembles the latter. The two genera should, perhaps, be united.

CYNAPIUM APIIFOLIUM, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 640. Tamul Pass, April 11; in flower. This plant had not been found before in California.

SUBGENUS? MICROTÆNIA. Calycis margo obsoletus. Petala ovata, cum lacinula elongata inflexa. Stylopodium minutum, depressum. Styli elongati, recurvi. Fructus ovalis, a latere contractus. Mericarpia jugis obtusissimis; valleculis 3–5-vittatis. Commissura 6–8-vittata,

crassa, spongiosa. Herba Californica, glabra. Folia decomposita. Involucrum oligophyllum. Involucella 6–8-phylla.

Cynapium? (Microtænia) Bigelovii. Hill sides, near Murphy's, California; May 16. Stem 3 feet or more in height. Lower leaves a foot long, ternately decompound; segments pinnately incised, with linear-lanceolate lobes. Umbels on long naked peduncles. Rays about 12, 2 or 3 inches in length. Involucre of 5–6 linear leaves. Involucels somewhat lateral, the leaflets lanceolate and reflexed, longer than the flowers. Umbellets monœcious, many-flowered; the male flowers mostly central. Petals apparently white. Fruit (immature) about 3 lines long; the ribs very indistinct. Vittæ extremely minute, forming an almost uninterrupted circle around each mericarp. Differs from Cynapium in its much more compressed fruit, nearly obsolete ribs, and in having an involucrum. Very likely the mature fruit would show other differences.

Thaspium montanum, *Gray, Pl. Fendl. p.* 57, *and Pl. Wright.* 2, *p.* 65. Sandia mountains, New Mexico; October.

Conioselinum Canadense, *Torr. & Gray, Fl.* 1, *p.* 69. Near Santa Antonita, in mountain marshes; October. In fruit.

Deweya? acaulis (sp. nov.): humilis; foliis 5–9-foliolatis e rhizomate repente crasso scapum nudum simplicem subæquantibus; foliolis cuneatis sessilibus acute trifidis quandoque 3–5-fidis lobis patentibus acutis integerrimis; umbella solitaria; fructu subtereti, valleculis univittatis In crevices of rocks near Santa Antonita, New Mexico; October. Of this there are only one or two specimens in the collection, with some mature fruit, but no flowers. The genus is altogether doubtful; but it may, perhaps, be referred to Deweya until it is better known; although the fruit is but slightly campylospermous, so that the plant should, perhaps, be referred to the Seselineæ. The seeds and the root-stock have a pleasant aromatic odor, much as in Ligusticum; from which genus, as well as from Deweya, our plant differs in the single large vittæ which fill the narrow intervals between the thick and corky, almost winged, rather obtuse ribs.

Deweya arguta, *Torr. & Gray, Fl.* 1, *p.* 641. Near San Gabriel; March 22; in flower. *β.* foliis triternati-sectis; involucellis elongatis. D.? (n. sp.) *Benth. Pl. Hartw., p.* 312; *Durand, Pl. Pratt. p.* 89. Mountains near Oakland; April 5; in flower only. The Oakland plant must be only a form of D. arguta, with the leaves more divided than usual.

Apiastrum angustifolium, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 644. Hill sides, Napa valley; April 26; plains near San Gabriel; March 23. We doubt whether A. latifolium is a distinct species from this.

ARALIACEÆ.

Aralia racemosa, *Linn. Spec.* 1, *p.* 273? Bolinas bay, California; April 19; scarcely in flower. The inflorescence is less compound, and the serratures of the leaves are much coarser than in the eastern plant. Very likely this will prove to be a distinct species.

CORNACEÆ.

Cornus Nuttallii, *Audubon, Birds of Amer. t.* 367; *Torr. & Gray, Fl.* 1, *p.* 655; *Nutt. Sylv.* 3, *p.* 51, *t.* 97. C. florida, *Hook. Fl. Bor.-Am.* 1, *p.* 277, (ex parte.) Hill sides and ravines, Duffield's Ranch, Sierra Nevada; May 12; in full flower. This beautiful tree attains its highest perfection in lower Oregon, where Mr. Nuttall found it growing seventy feet high. The involucral leaves vary in form. They are sometimes nearly as broad as in C. florida.

Cornus sessilis, *Torr.* (*in Durand, Pl. Pratt. p.* 89): floribus paullo ante folia late ovata subtus pubescentia nascentibus; involucri foliis acutis; petalis acuminatis. (Tab. VIII.) Wet ravines near Grass valley, California; May 20; with young fruit. A small tree, (10–15 feet high,) with smooth, slender, flexile branches. Leaves $2\frac{1}{2}$ inches long and $1\frac{1}{2}$ inch wide, dull, closely approximated towards the extremity of the flowering branches. Umbel 15–20-flowered, appearing

rather before the leaves, usually becoming lateral from the development of only one of the buds near the extremity of the flowering branch: pedicels 4–6 lines long, villous. Involucre nearly as long as the pedicels, very deciduous; the leaflets ovate, acute, yellowish, or tinged with purple. Teeth of the calyx minute, crowning the ovary. Petals lanceolate, or ovate-lanceolate, acuminate. Style filiform; stigma slightly dilated. Immature fruit twice as long as broad, somewhat hairy. This species, remarkable as the only one of the section Tanycrania found in America, is closely allied to C. mas of Europe and C. officinalis of Japan, differing only, so far as our imperfect materials show, in the slight characters given above. Dr. Bigelow's specimens have the foliage and the young fruit. A branchlet gathered by Mr. Pratten exhibits the flowers just developing.

Cornus pubescens, *Nutt. in Torr. & Gray, Fl.* 1, *p.* 652, (sub var. C. sericea,) & *Sylv.* 3, *p.* 54. C. circinata, *Cham. & Schlecht. in Linnæa* 3, *p.* 139. C. sericea, *β*? occidentalis, *Torr. & Gray, l. c.* River banks and ravines. Grass valley and Middle Yuba; May 20. Also, hillsides, Duffield's Ranch, Sierra Nevada; May 12; with unexpanded flowers. We incline to the opinion that this species is more nearly allied to C. alba (stolonifera) than to C. sericea. It varies in the degree of pubescence and in the breadth of the leaves.

CAPRIFOLIACEÆ.

Lonicera involucrata, *Banks; DC. Prodr.* 4, *p.* 336. Near San Francisco, California.

Lonicera Californica, *Torr. & Gray, Fl.* 2, *p.* 7. Knight's ferry on the Stanislaus. A small-leaved form. L. hispidula is a more or less hairy state, apparently of the same species.

Symphoricarpus rotundifolius, *Gray, Pl. Wright.* 2, *p.* 66. In the Sandia mountains near Santa Antonita, New Mexico; October. In fruit.

Sambucus Mexicana, *Pres. in DC. Prodr.* 4, *p.* 323; *Gray, Pl. Wright.* 2, *p.* 66. S. glauca, *Benth. Pl. Hartw. p.* 313, (non *Nutt.*) S. velutina, *Durand & Hilg. Pl. Heerm. in Journ. Acad. Sc. Phil.* (*n. ser.*) 3, *p.* 39, (a more pubescent form.) Knight's ferry, Stanislaus river, May 7, (in flower;) also on Mark West's creek, California. Our specimens agree very well with the plant collected in New Mexico by Mr. Wright.

Sambucus pubens, *Michx. Fl.* 1, *p.* 181; *Torr. & Gray, l. c., p.* 13. Hills near Oakland, California.

RUBIACEÆ.

Oldenlandia (Houstonia) rubra, *Gray, Pl. Wright.* 2, *p.* 68. Hills and plains near Galisteo, New Mexico; October.

Galium aparine, *Linn. Sp.* 1, *p.* 108. San Francisco and Napa valley; May. A small-fruited form, apparently of this species, occurring in various collections from California, New Mexico, and western Texas.

VALERIANACEÆ.

Plectritis congesta, *Lindl.; DC. Prodr.* 4, *p.* 631. Mountains near Oakland; April—May.

Plectritis macrocera, *Torr. & Gray, Fl.* 2, *p.* 50. P. brachystemon, *Fisch. & Mey.* Napa valley; April.

COMPOSITÆ. (By A. Gray.)

Elephantopus Carolinianus, *Willd.* On the Canadian River; August.

Vernonia Jamesii, *Torr. & Gray, Fl.* 2, *p.* 58. On the Canadian; and Llano Estacado; August—September.

Pectis (Pectidopsis) angustifolia, *Torr. in Ann. Lyc. New York* 2, *p.* 214; *Gray, Pl. Fendl. p.* 61. Head waters of the Canadian. September.

Hofmeisteria pluriseta (sp. nov.): fruticulosa, pubcrula; foliis oppositis et alternis parvis plerumque hastato-trifidis inciso-dentatis; involucri squamis floribusque 20–25; pappi paleis 10–12 lineari-lanceolatis (aut muticis aut partim acuminato-aristatis,) cum setis totidem tenuibus denticulatis. (Tab. IX.) In a cañon at Bill Williams' fork, now called Williams' river; February This is evidently a congener of Helogyne fasciculata, *Benth.*, of southern California, and apparently of Phania? urenifolia, *Hook. & Arn.* also, although the number of scales and awns of the pappus (2–3 in the former and 4–5 in the latter) is thrice or twice greater. On account of the earlier Helogyne of Nuttall, (founded on an obscure Eupatoriaceous plant from Peru, but apparently with good characters,) the late Dr. Walpers has changed the name of Bentham's genus to Hofmeisteria, in honor of one of the best phytotomists of the age. This genus, strengthened by a third species, is well marked in habit as well as character. All have palmately-lobed or divided leaves on very long petioles. In H. pluriseta the petioles are an inch or an inch and a half long, while the blade is only 4 to 6 lines long. The latter is ovate or deltoid in outline, and irregularly cut into 3–6 coarse teeth or lobes, the two basal ones usually largest and divergent. Involucre as in Brickellia; the scales acuminate. Corolla ochroleucous; the slightly dilated summit 5-toothed. Style, &c., as in H. fasciculata. Achenia oblong, nearly terete, 5-ribbed, minutely hirsute. Paleæ of the pappus 10 or 12, hyaline, with somewhat erose margins, entire at the summit, which is either obtuse, retuse, or several of them more commonly produced into an acuminate point, or into a short awn, the latter above half the length of the achenium. Bristles of the pappus as many as the paleæ, and alternate with them, forming an inner series as long as the corolla, nearly capillary, minutely denticulate.

Liatris punctata, *Hook. Fl. Bor.-Am.* 1, *p.* 306, *t.* 55. Rocky prairies, from the Canadian river, August 26, to the Llano Estacado; August–September.

Liatris squarrosa, *Willd.* Prairies; August 26.

Liatris elegans, *Willd.; Torr. & Gray, Fl.* 2, *p.* 48. Shawnee villages, Canadian; August.

Carphochæte Bigelovii, *Gray, Pl. Wright.* 1, *p.* 89; & 2, *p.* 71. On the mountains near the Mimbres; April; *Dr. Henry.*

Kuhnia eupatorioides, *Linn.*, Var. corymbosa, *Torr. & Gray, Fl.* 2, *p.* 78. Deer creek, of the Canadian; August.

Kuhnia eupatorioides, Var. gracillima, *Gray, Pl. Lindh.* 2, *p.* 218. Anton Chico; September; and on the San Domingo, New Mexico; October.

Brickellia brachyphylla, *Gray, Pl. Wright.* 2, *p.* 84. Clavigera brachyphylla, *Gray, Pl. Fendl. p.* 63. On bluffs and rocky plains of the Llano Estacado; September. Root thick and long. Pappus nearly plumose.

Brickellia Wrightii, *Gray, Pl. Wright.* 2, *p.* 72. Arroyos and washed places, near the Llano Estacado; September.

Brickellia Californica, var. *Gray, Pl. Fendl. p.* 64. Rocky hills and plains on the San Domingo, New Mexico, &c. This is the same as Fendler's plant; but its bushy habit, cordate leaves, and smaller heads indicate it as probably distinct from B. Californica; and it is very likely to pass into B. Wrightii.

Brickellia grandiflora, *Nutt.; Gray, Pl. Fendl. p.* 63. La Cuesta, New Mexico; September.

Eupatorium ageratoides, *Linn. f.* Shawneetown, on the Canadian; August.

Eupatorium ageratifolium, var.? herbaceum, *Gray, Pl. Wright.* 2, *p.* 74. Anton Chico, New Mexico; in rocky arroyos, &c. A small-leaved form.

Eupatorium serotinum, *Michx. Fl.* 2, *p.* 100. Grande Prairie, on the Canadian; August 22.

Eupatorium altissimum, *Linn.* On the Canadian, &c.; August.

Conoclinium cœlestinum, *DC.* Shawnee villages; August.

Nardosmia palmata, *Hook. Fl. Bor.-Am.* 1, *p.* 308. Tussilago palmata, *Ait. Hort. Kew. ed.* 1, 3, *t.* 2. Wet places along mountain streams, Oakland, California; April 5. A plant of wide range, yet of very rare occurrence.

MACHÆRANTHERA TANACETIFOLIA, *Nees. Ast., p.* 224; *Gray, Pl. Wright.* 1, *p.* 90. On the Canadian, &c.; September.

MACHÆRANTHERA CANESCENS, *Gray, Pl. Wright.* 1, *p.* 89. Banks of the Pecos, &c., northwestern Texas, (smooth varieties); gravelly hills near the Colorado of the west; February.

ASTER BIGELOVII (sp. nov.): ramis viscido-hirsutis ad apicem usque foliosis; ramulis corymbosis monocephalis; foliis membranaceis oblongo-lanceolatis semiamplexicaulibus grosse serratis tenuiter triplinerviis hirto-puberulis glabratis; capitulis magnis globosis; involucri pluriserialis squamis attenuato-subulatis basi appressis superne longe caudato-appendiculatis squarroso-recurvis glanduloso-viscidis; acheniis glaberrimis. Arroyos in the Sandia mountains; October. A wholly new and most remarkable Aster, of the Grandiflori group; but the apparently showy heads larger than those of A. grandiflorus, being an inch in diameter, and the numerous (blue and violet) rays an inch long. It is probably a tall plant; but the base of the stem was not collected. Cauline leaves two or three inches long, coarsely dentate-serrate throughout; the uppermost, and those of the short branchlets, smaller and less toothed. Scales of the imbricated involucre half an inch long when extended, very slender; the long and almost filiform appendicular portion recurved, spreading and very glandular. Receptacle flat, alveolate; the alveolæ short and entire. Achenia perfectly glabrous, linear, compressed, three lines long. Pappus not abundant, nearly in a single series.

ASTER NOVI-BELGII, *Linn.; Gray, Pl. Wright.* 2, *p.* 76. Sandia mountains, New Mexico.

ASTER LÆVIS, *Linn.; Torr. & Gray, Fl.* 2, *p.* 116. San Antonio, New Mexico; October; in mountain ravines.

ASTER PATENS, *Ait.; Torr. & Gray, l. c.* On the Canadian, &c.; August–September.

ASTER MULTIFLORUS, *Ait.* Rocky dell, Eastern New Mexico; September 17.

ASTER NUTTALLII, *Torr. & Gray, Fl.* 2, *p.* 126; var. FENDLERI; foliis rigidioribus hispido-ciliatis; involucri squamis granuloso-glandulosis. A. Fendleri, *Gray, Pl. Fendl. p.* 66. Rocky ravines and cañons, Llano Estacado; September. Exactly Fendler's plant; but it appears to differ from A. Nuttallii only in its greater rigidity, and the more manifest hispid bristles on the branches and the margin of the leaves.

ASTER (OXYTRIPOLIUM) PAUCIFLORUS, *Nutt.; Gray, Pl. Wright.* 2, *p.* 76. San Domingo, New Mexico; October.

ASTER (OXYTRIPOLIUM) DIVARICATUS, *Nutt.; Torr. & Gray, Fl.* 2, *p.* 162. Sand-banks of the Canadian; August.

ASTER (OXYTRIPOLIUM) ANGUSTUS, *Torr. & Gray, l. c.; Gray, Pl. Wight.* 2, *p.* 76. In wet springs, Eastern New Mexico.

DIPLOPAPPUS ERICOIDES, *Torr. & Gray, l. c.* Laguna Colorado, New Mexico, September.

ERIGERON (CÆNOTUS) DIVARICATUM, *Michx., Fl.* 2, *p.* 534. Dogtown prairies; September.

ERIGERON (CÆNOTUS) SUBDECURRENS. Conyza subdecurrens, *Gray, Pl. Fendl. p.* 78. Plains and prairies, Eastern New Mexico; September 21.

ERIGERON MACRANTHUM, *Nutt.*; *Gray, Pl. Fendl. p.* 67. Mountain arroyos, near San Antonio, New Mexico.

ERIGERON BELLIDIASTRUM, *Nutt.; Torr. & Gray, Fl.* 2, *p.* 170. Sand-hills on the Upper Canadian; September.

ERIGERON PHILADELPHICUM, *Linn.; Torr. & Gray, Fl.* 2, *p.* 171. Near Santa Rosa, Benicia, and Cocomungo, California; March–May.

ERIGERON DIVERGENS, *Torr. & Gray, Fl.* 2, *p.* 175; *Gray, Pl. Wright.* 2, *p.* 77, (nearly the var. CINEREUM.) Hills in the Butte mountains near Marysville, California; May 25. The lower leaves are mostly lobed or almost divided, and the stems become lignescent at the base.

ERIGERON DOUGLASII, *Torr. & Gray, l. c.* Hill-sides on the Stanislaus river at Robinson's Ferry, California. Mr. Thurber and others have gathered a very narrow-leaved state of this near San Diego.

ERIGERON MODESTUM, *Gray, Pl. Fendl. p.* 68, *& Pl. Lindl.* 2, *p.* 220; excl. syn. DC. Rocky ravines on the Llano Estacado; September.

Erigeron stenophyllum (sp. nov.): humile, cæspitosum, pube appressa tenuiter cinereum; caulibus floriferis simplicibus e caudice perenni inferne foliosissimis apice nudo monocephalis; foliis angustissime linearibus integerrimis; capitulo magno; ligulis (semipollicaribus et ultra) circiter 40 albis uniseriatis involucro pubescente multo longioribus; acheniis hirsutissimis; pappo simplici. On hill-sides and steep banks of the Pecos; October. Stems six to ten inches high, growing in dense tufts. Leaves one to three inches long, about a line wide, many of them almost filiform; the lower ones tapering to the base, which is not ciliate nor hirsute; all merely cinereous with a very fine and close strigose pubescence. Scales of the involucre all nearly equal and similar, scarcely biserial, linear-lanceolate, acuminate, three or four lines long, somewhat tomentose-pubescent. Rays linear, broad for the genus, apparently pure white or slightly tinged with purple, certainly not ochroleucous. Achenia flat, two-nerved, densely hirsute with long and white hairs. Pappus similar in the ray and disk, composed of a single series of scabrous capillary bristles of about the length of the disk-corolla, not fragile nor caducous, of equal length, and not accompanied by short setæ or squamellæ. This most resembles E. ochroleucum, *Nutt.*; but the leaves are hoary with a finer pubescence, and are not hirsute towards the base; the heads are longer and more showy, the rays not ochroleucous, the achenia remarkably villous-hirsute, and the exterior pappus wanting.

Eremiastrum bellioides, *Gray, Pl. Nov. Thurb., p.* 320. Gravelly hills near the Colorado, interior of California; February. Precocious specimens, less than an inch high, just beginning to flower. Mature fruit of this plant is a desideratum.

Townsendia grandiflora, *Nutt. in Trans. Amer. Phil. Soc.* 7, *p.* 305; *Torr. & Gray, Fl.* 2, *p.* 186. Erigeron? florifer, *Hook. Fl. Bor.-Am.* 2, *p.* 20. Sand-hills and rocky ridges of the Antelope hills on the Canadian; September.

Townsendia eximia, *Gray, Pl. Fendl. p.* 70. Laguna Blanca, in pine woods, and Santa Antonita, New Mexico, in mountain ravines; October. The root of this striking and well-marked species is perhaps perennial. The branching stems sometimes attain the height of a foot and a half.

Aphanostephus Arkansanus, *Gray, Pl. Wright.* 1, *p.* 93. Valley of the Canadian, at Shawneetown; August.

Amphiachyris dracunculoides, *DC.; Torr. & Gray, Fl.* 2, *p.* 122. Ravines on Walnut creek, of the Canadian; August.

Gutierrezia Euthamiæ, *Torr. & Gray, Fl.* 2, *p.* 123. Antelope hills of the Canadian; September.

Gutierrezia sphærocephala, *Gray, Fl. Fendl. p.* 73. Prairies and plains near the Pecos, New Mexico, September 21.

Solidago rigida, *Linn.* At Beavertown, on the Canadian; August.

Solidago pumila, *Torr. & Gray, Fl.* 2, *p.* 210. On the Pecos, New Mexico; October.

Solidago tenuifolia, *Pursh.*. Sand-hills and Antelope hills on the Canadian; September.

Solidago Radula, *Nutt. in Jour. Acad. Philad.* 7, *p.* 102. With the foregoing, and on the Llano Estacado; September.

Solidago Canadensis, *Linn.* Deer creek, of the Canadian; August.

Linosyris Wrightii, *Gray, Pl. Wright.* 1, *p.* 95. Between the Canadian and the Pecos, September 15.

Linosyris (Chrysothamnus) graveolens, *Torr. & Gray, Fl.* 2, *p.* 234. Wet places and banks of creeks between the Canadian and the Pecos rivers.

Linosyris (Chrysothamnus) Bigelovii (sp. nov.): fruticosa, ramosissima, cinerea; ramis flexuosis fastigiato-polycephalis; foliis filiformibus supra canaliculatis; capitulis 5-floris; involucro elongato floribus tertia parte breviore, squamis 5-floris 4–5-seriatis pallidis carinatis arachnoideo-ciliatis subacutis appressis, extimis oblongis, intimis lineari-lanceolatis; acheniis acute 5-angulatis glaberrimis; pappo copioso, setis tenuibus inæqualibus. (Tab. XII.) Hills and arroyos, Cienegella, above Albuquerque, New Mexico. A dense and fastigiate shrub, apparently

of two or more feet in height; the branchlets whitish or yellowish, but with scarcely a perceptible pubescence. Leaves more hoary, about an inch long, involute-filiform, slender. Heads fasciculate, 9 or 10 lines long, about a line and a half in diameter, therefore more slender than those of L. pulchella; the scales of the involucre almost as strikingly five-ranked as in that species, but thinner, not so sharply carinate, not green on the back, and not so much pointed, the somewhat scarious margins, especially of the outer ones ciliate with arachnoid and apparently viscid hairs. Corolla, style, and the slender achenia nearly as in L. pulchella; but the bristles of the pappus rather less copious, evidently finer and softer, and unequal in length, therefore intermediate between that of the latter species and of L. graveolens. This species is a peculiarly interesting discovery, on account of the transition it establishes between L. pulchella, a strikingly aberrant form, and the rest of the group to which I had referred to that plant.

Linosyris (Chrysothamnus) pulchella, *Gray, Pl. Wright.* 1, *p.* 96, & 2, *p.* 80; *Torr. in Sitgreaves' Rep. t.* 4. Gravelly hills on the upper Canadian, September. The margins of the leaves are denticulate-ciliolate, which was not observed in Mr. Wright's specimens. Dr. Schultz (Bipont,) informs me, in a letter, that he has indicated this as a new genus, "Tetragonospermum pulchellum, *C. H. Schultz, Mss.*" I think that the preceding species forbids its separation from Nuttall's Chrysothamnus, whatever view we take of that group.

Aplopappus (Blepharodon) spinulosus, *DC.* and var. glaber, *Gray, Pl. Fendl. p.* 75. On the Canadian, and Deer creek; August, September.

Aplopappus (Blepharodon) rubiginosus, *Torr. & Gray, Fl.* 2, *p.* 240. Sandy bottoms of the Canadian; September.

Aplopappus (Prionopsis) ciliatus, *DC. Prodr.* 5, *p.* 346; *Gray, Pl. Wright.* 1, *p.* 98. Prairies on the Canadian; September.

Aplopappus (Isopappus) divaricatus. Isopappus divaricatus, *Torr. & Gray, Fl.* 2, *p.* 239. Sand-banks of the Canadian, near the Shawnee villages; August. A state with rather larger heads, approaching Isopappus Hookerianus, which most probably is not distinct.

Aplopappus (Ericameria) laricifolius, *Gray, Pl. Wright.* 2, *p.* 80. White Cliff creek, New Mexico; on hills and rocks. Cañon creek, Western New Mexico. The flowers have all fallen; but there is little doubt about the species, which Dr. Bigelow formerly gathered in the Organ Mountains, near El Paso.

Ammodia Oregana, *Nutt. in Trans. Amer. Phil. Soc.* 7, *p.* 321; *Torr. & Gray, Fl.* 2, *p.* 235, California, on the Stanislaus; May 8. This was also gathered in northern California by the United States South Sea Exploring Expedition, and by Mr. Allen on the Yuba river.

Stenotus linearifolius, *Torr. & Gray, Fl.* 2, *p.* 238. Cañon Pass, New Mexico; March 16, 1854; California.

Chrysopsis hispida, *Hook.; Nutt. in Trans. Amer. Phil. Soc. n. ser.* 7, *p.* 316. Sandstone rocks and hills, on the Canadian; August—September.

Chrysopsis foliosa, *Nutt. l. c.* Hilly prairies on the Canadian; September. Intermediate between C. villosa and C. canescens.

Heterotheca grandiflora, *Nutt. in Trans. Amer. Phil. Soc. n. ser.* 7, *p.* 315. Cocomungo, California.

Grindelia hirsutula, *Hook. & Arn. Bot. Beech. p.* 147 & 351. Hill-sides, at Knight's ferry, on the Stanislaus, California; May 7. A narrow-leaved state.

Pentachæta aurea, *Nutt. l. c.; Torr. & Gray, Fl.* 2, *p.* 249. Corte Madera, California; April. Very like Nuttall's original specimens, except that the leaves are broader.

APHANTOCHÆT, ANov. Gen.

Capitulum heterogamum, 8–10-florum; floribus radii 3–5 fœmineis, tubulo corollæ stylo breviore truncato eligulato; disci 4–5 hermaphroditis, corolla tubuloso-infundibuliformi apice 5-dentata. Involucrum circiter 10-phyllum, biseriale; squamis æqualibus oblongis membranaceis

margine lato hyalinis dorso subcarinatis obtusis mucronatis. Receptaculum parvum, alveolato-dentatum. Antheræ ecaudatæ. Styli rami fl. fœm. lineari-filiformes prorsus stigmatosi; fl. herm. plani appendice longa subulato-filiformi hispida superati. Achenia conformia, vel disci substerilia, hirsuta, oblonga, compresso-pentagona, 5-nervia. Pappus e setulis 5 brevissimis ad nervos respondentibus, vix manifestus. Herba annua, tenerrima; caulibus filiformibus 2–4-pollicaribus erectis parce arachnoideo-villosis ramisque paucis superne nudis monocephalis; foliis alternis filiformibus integerrimis; floribus ut videtur luteis mox purpurascentibus.

Aphantochæta exilis. (Tab. XI.) Hill-sides in the Napa Valley, California; April 25. A delicate, almost capillary little plant, becoming glabrous; the stems or branches naked above for an inch or so, and terminated by a head of 3 lines in length, below rather leafy, the leaves half an inch or more in length. Scales of the involucre greenish, except the margins, shining, nearly equaling the flowers. Corolla of the ray reduced to a tube, sheathing the style and about half its length, the apex somewhat obliquely truncate, with no vestige of a ligule. Disk-corollas with rather slender tubes; the throat dilated, the border equally 5-toothed. Appendages of the style twice the length of the stigmatic portion. Mature achenia not seen. The five rudimentary setulæ of the pappus do not exceed the hairs of the achenium in length. This curious little Composita exhibits that modification of the Asteroid style which is seen in Pentachæta, Bradburia, Xanthisma, &c. From the technical characters, the genus would fall into De Candolles div. Solenogyneæ. But the genus to which I imagine it is most related has true rays, namely, the California genus Pentachæta, *Nutt.;* from which it differs mainly in the fewer-flowered heads, the entire suppression of the ligule, the longer proper tube of the corolla in the disk, and the reduction of the five bristles f the pappus to minute rudiments. The latter character furnishes the generic name.

Pericome caudata, *Gray, Pl. Wright.* 2, *p.* 81. On rocky hills at San Domingo, New Mexico; October. Also gathered by Dr. Henry on the Mimbres.

Perityle nuda, *Torr. in Bot. Emory's Mex. Bound. ined.*: herbacea, ramosissima; foliis plerisque alternis subcordato-rotundis 5–7-lobis crebre laciniato-dentatis incisisve cum ramulis junioribus subpubescentibus glanduloso-viscosis; involucri squamis oblongis; ligulis oblongis discum haud superantibus; appendicibus styli fl. hermaph. brevibus obtusis; acheniis oblongo-linearibus marginibus villosissimo-ciliatis; pappo e squamellis hyalinis coroniformi-concretis pilis achenii brevioribus; aristis omnino nullis. (On the Rio Gila, near the Pimo village. Dr. Parry.) Arroyos and cañons at Williams' River, and on hills near the Colorado of the West; February 7. Plant a span to a foot or more high, probably annual. Leaves half an inch or more in diameter, moderately lobed, much laciniated and toothed. Heads three or four lines in diameter. Scales of the involucre very thin, hispid-ciliate towards the summit. Disk deep yellow; the small rays nearly white in the specimen. Receptacle convex, scrobiculate. Disk-corollas 4-toothed. Achenia a line and a half long, the margin densely villous-hispid. This species, which has no awns to the pappus, together with P. aglossa, *Gray, Pl. Wright.* 2, *p.* 107, which wants the rays, nearly effects a transition to Pericome, *Gray, l. c., p.* 81. The subjoined species, having (so far as the imperfect and scanty specimens show) no pappus at all, and no strong fringe on the margins of the achenium, carries the variations of this genus to an extreme.

Perityle Fitchii (*Torr. ined.*): herbacea, humilis, viscosissimo-pubescens; foliis oppositis et alternis cordato-rotundis inciso-crenatis dentibus crenulatis; involucri squamis oblongis; ligulis oblongis discum superantibus; appendicibus styli fl. hermph. subulatis; acheniis linear-oblongis 3–4-nervatis ad nervos hirsutulis; pappo plane nullo. California; *Rev. Mr. Fitch.* Stems or branches three inches long, probably from a depauperate plant, clothed (as are the leaves in a lesser degree) with a glandular and very viscous villous pubescence. Leaves half an inch or less in diameter, subcordate, on slender petioles. Heads five to six lines in diameter. Scales of the involucre oblong, or oblong-lanceolate, villous, bearded at the tip. Receptacle convex. Flowers yellow; the rays moderately exserted. Disk-corollas 4-toothed, the teeth sparingly bearded on the back. Branches of the style tipped with slender and acute, but rather

short, appendages. Achenia compressed, usually with two approximate nerves at each margin, which are barely hirsute, terminated by a small, disk-shaped, rather prominent areola, which is entirely naked, there being no trace of a pappus.

Baccharis Douglasii, *DC. Prodr.* 5, *p.* 400; *Torr. & Gray, Fl.* 2, *p.* 259; excl. syn. P. Pingræa, &c. Along streams; Napa Valley, (male,) and Cocomungo, (female); California, March and April. The leaves often denticulate.

Baccharis sergiloides, (sp. nov.): suffruticosa, glabra, confertim ramosissima; ramis ramulisque angulatis rigidis articulatis sæpissime aphyllis; foliis dum adsunt parvis spathulatis uninerviis, ramulorum ad bracteas minimas reductis, capitulis parvis in ramulos confertis subsessilibus, masculis magis glomeratis; involucro obovato, squamis multiseriatis appressis glabris oblongis, seu interioribus lanceolatis, fœm. acutis, masc. omnibus obtusis; receptaculo conico subpaleaceo; acheniis glabris; pappo brevi. Dry arroyos, fifty miles west of the Colorado, western New Mexico. A very bushy, broom-like plant, with small heads, apparently abundant on the Gila, where Colonel Emory and others have gathered specimens.

Baccharis Texana, *Gray, Pl Fendl. p.* 75. Prairies, &c. Comanche plains, Northwestern Texas; September.

Baccharis salicina, *Torr. & Gray, Fl.* 2, *p.* 258. Sand-banks of the Canadian, near the Shawnee villages; August.

Pluchea fœtida, *DC. Prodr.* 5, *p.* 452. On the Canadian; August.

Tessaria (Phalacrocline) borealis, *Gray, Pl. Fendl. p.* 75, & *Pl. Wright* 1, *p.* 102. Williams's river; February.

Stylocline gnaphalioides, *Nutt. in Trans. Amer. Phil. Soc., l. c.; Torr. & Gray, Fl.* 2, *p.* 267; var. Bigelovii: foliis spatulato-oblongis vel sublinearibus; paleis receptaculi fructiferis dorso multo magis lanatis. (Tab. XIII.) California; along rivulets near Knight's ferry, on the Stanislaus river; May. Plant a span high, rather stouter, and with larger and broader leaves, and larger heads than in our specimens of Nuttall's plant; which, however, are poor, and perhaps depauperate. The heads are not larger in Dr. Bigelow's plant than those of S. gnaphalioides are described to be; but the paleæ are more woolly on the back, which perhaps is more deeply saccate, especially in the upper ones. In both, however, the saccate portion enclosing the fruit is larger than the hyaline wing in the uppermost fructiferous paleæ. The male flowers are subtended by one or two small and linear glabrous paleæ; their scanty pappus is sometimes barely denticulate, sometimes barbellate-toothed.

Evax (Hesperevax) caulescens. Psilocarphus caulescens, *Benth. Pl. Hartw. No.* 1812, *p.* 319. (Tab. XI.) Napa Valley, California; April 25. This plant is no Psilocarphus, but essentially an Evax. The achenia are obcompressed, and the paleæ barely concave (not complicate): the latter are of a firm, chartaceous texture, and persistent on the villous cylindrical receptacle, or the uppermost (which form an involucrate verticil around the 6–8 sterile flowers) herbaceous, all pointless, or nearly so. Achenia smooth.

Psilocarphus tenellus, *Nutt. l. c.* Near San Francisco and Mark West's creek, California; April. Quite distinct from P. globiferus, to which Nuttall's P. brevissimus and P. Oreganus are likely to belong.

Micropus Californicus, *Fisch. & Meyer; DC. Prodr.* 7, *p.* 283. Napa valley and Corte Madera, California; April.

Eclipta erecta, *Linn.* River banks, Shawneetown, Arkansas; August.

Blennosperma Californicum, *Torr. & Gray, Fl.* 2, *p.* 272. Rancho of San Geronimo, California; April.

Polymnia Uvedalia, *Linn.* Woods, on the Lower Canadian; August.

Melampodium cinereum, *DC. Prodr.* 5, *p.* 518. Prairies, on the Canadian; September.

Berlandiera Texana, *DC. Prodr.* 5, *p.* 517. Bottom lands and prairies, on the Canadian and Walnut creek; August.

Berlandiera lyrata, *Benth. Pl. Hartw.; Gray, Pl. Fendl. p.* 78. Plains of the Canadian; September.

Engelmannia pinnatifida, *Torr. & Gray.* Prairies, on the Canadian; September.

Parthenium incanum, *H. B. K. Nov. Gen. & Spec.* 4, *p.* 260, *t.* 391. Rocky hills, between the Canadian and the Pecos; September.

Euphrosyne xanthiifolia, *Gray, Pl. Wright.* 2, *p.* 85. Cyclachæna xanthiifolia, *Fresenius.* Bottom of creeks, Comanche plains, Northwestern Texas, September.

Iva ciliata, *Willd.; Torr. & Gray, Fl.* 2, *p.* 287. On Deer creek; August.

Ambrosia aptera, *DC. Prodr.* 5, *p.* 527; *Gray, Pl. Lindh.* 2, *p.* 226. On the Canadian; August.

Ambrosia coronopifolia, *Torr. & Gray, Fl.* 2, *p.* 291. With the preceding.

Franseria ambrosioides, *Cav. Ic.* 2, *t.* 200. Mountain cañons, near Bill Williams' fork; February, (in fruit.)

Franseria dumosa, *Gray, in Frém. Report* 2, *p.* 316? On the Mohave river, March. Branches, destitute of inflorescence.

Franseria tenuifolia, var. tripinnatifida, *Gray, Pl. Lindh.* 2, *p.* 227. Plains, between the Canadian and the Pecos; September.

Franseria Hookeriana, *Nutt.; Torr. & Gray, Fl.* 2, *p.* 294. Low places, Pecos to Galisteo; September—October.

Franseria tomentosa, *Gray, Pl. Fendl. p.* 80. Bottoms of the Canadian; September. The specimens resemble those of Fendler, and bear mature fruit.

Xanthium echinatum, *Murray; Torr. & Gray, Fl.* 2, *p.* 295. On the Canadian river.

Zinnia (Diplothrix) grandiflora, *Nutt.; Gray, Pl. Fendl. p.* 81, *& Pl. Wright.* 1, *p.* 105. Dogtown prairies, Northwestern Texas; September.

Wyethia helenioides, *Nutt.; Gray, Pl. Fendl. p.* 82. Alarçonia helenioides, *DC. Prodr.* 5, p. 537. Hill-sides, Oakland, California; April.

Wyethia augustifolia, *Nutt. in Trans. Amer. Phil. Soc. l. c.; Torr. & Gray, Fl.* 2, *p.* 300. Hills, near Punta de los Reyes, California; April.

Wyethia scabra, *Hook. in Lond. Jour. Bot.* 6, *p.* 247: foliis linearibus seu lineari-lanceolatis acutatis (inferioribus sæpe oppositis) integerrimis sessilibus venoso-trinervibus utrinque cum caule stricto gracili ultrapedali hispidulo-scaberrimis; capitulo solitario nudo; involucro hemisphærico disco breviore, squamis pluriseriatim imbricatis appressis coriaceis oblongis, exterioribus appendice foliosa lineari patente auctis, interioribus pungenti-mucronatis; acheniis glaberrimis compresso-quadrangulatis pappo brevissimo calyculiformi irregulariter dentato coronatis. Sand bluffs, near Inscription Rock, on the Puerco of the West, New Mexico. A remarkable species, of which only fruiting specimens were gathered. The stems are over a foot long, and do not show the base; possibly they are only branches, but they are perfectly simple. These, like the leaves, (which are 4 to 6 inches long, and 3 to 7 lines wide,) are very rough with short and close papillose bristles, much as in Helianthus Maximiliani. The short and sparing veins are confluent into a false nerve within the margin on each side, making the leaf appear three-nerved. Head short-peduncled, an inch in diameter. Rays not seen. Disk-corollas slender, glabrous. Achenia about 4 lines long, the angles very acute. This species completes the parallel between Wyethia and Balsamorhiza, having the involucre imbricated as in Balsamorhiza Hookeri, &c., while several species of the latter genus are now known with the entirely foliaceous involucres of Wyethia helenioides, augustifolia, &c. Without doubt, the plant described above is the same as that of Geyer.

Balsamorhiza macrophylla, *Nutt. l. c.*; var. pube minuta molli canescens; foliis plerisque elongatis (radicalibus subpedalibus) circumscriptione lanceolatis 1–2-pinnatipartitis, segmentis sæpe dentatis incisisve; involucri squamis exterioribus magnis foliaceis elongato-oblongis seu spathulatis quandoque dentatis. Hill-sides, near Sonoma, California; May. All the species of this group are extremely variable in foliage. I possess only a leaf of Nuttall's B. macrophylla,

and that shows no hoary pubescence; but a specimen from Frémont's collection (which is remarkable for the foliaceous scales of the involucre being as long as the rays, even two inches in length) connects Nuttall's plant with our own. The foliage is more like that of B. Hookeri, (to which B. hirsuta must belong,) but the involucre is very different.

Balsamorhiza deltoidea, Nutt. l. c.; var. glabrescens. B. glabrescens, *Benth. Pl. Hartw.*, No. 1785, p. 317; but with the leaves for the most part coarsely toothed, and some of them not cordate at the base. Hill-sides, Sonora, California; May. This was also collected by Frémont in his second journey, and is mentioned in the account of some new Compositæ of that collection (in Bost. Jour. Nat. Hist.) as a new Balsamorhiza, if not a form of B. deltoidea. There is scarce a doubt that they are all forms of one species.

Helianthella Californica (sp. nov.): hirsutula; caule ramoso; ramis apice longe nudis monocephalis; foliis omnibus longius petiolatis lanceolatis seu spathulato-lanceolatis e medio triplinerivis nitidulis; involucri squamis lineari-subulatis hirsutis ligulas subæquantibus; acheniis (immaturis) leviter obcordatis glaberrimis ala integerrima apice pappum brevissimum squamellato-setulosum gerentibus; aristis atque squamellis intermediis nullis. Napa valley, California, on hill-sides; April. The western species of this genus were founded on very incomplete materials, and greatly need revision. But this appears to be different from any before known, on account of the perfectly glabrous, awnless, neither ciliate nor lacerate achenia, with the pappus reduced to a tuft of very minute setæ or squamellæ at the summit of each smooth and entire wing; and the scales of the involucre are uniformly attenuate-subulate, not at all foliaceous. The naked peduncles are from 5 to 15 inches long. Leaves slightly scabrous, most of them opposite, 3 to 7 inches long, half an inch or an inch wide, or some of the larger occasionally rhomboid-dilated upwards, and these 2 inches wide; the cauline all on petioles of one or two inches in length.

Encelia Californica, *Nutt. l. c.; Torr. & Gray, Fl.* 2, *p.* 317. Los Angeles, California; March.

Encelia farinosa, *Gray, in Emory's Rep. p.* 143. A species of which no character has been published, but which is likely to prove not distinct from the E. nivea, *Benth. Bot. Voy. Sulph. p.* 27. Gravelly hills on the Colorado of the west; February.

Heliomeris multiflora, *Nutt. in Jour. Acad. Philad.* (*n. ser.*) 1, *p.* 171; *Gray, Pl. Fendl. p.* 171, *& Pl. Wright.* 2, *p.* 87. Banks of streams, San Domingo and New Mexico; October.

Lepachys columnaris, *Torr. & Gray, Fl.* 2, *p.* 315. Shawneetown; August. Var. pulcherrima, *Torr. & Gray, l. c.* Upper Canadian to New Mexico; September, October.

Lepachys Tagetes. L. columnaris, var. Tagetes, *Gray, Pl. Wright.* 1, *p.* 106. Rudbeckia Tagetes, *James, in Long's Exped.* 2, p. 68. Prairies on the Canadian; September. This appears to hold its characters, and to claim a place as a distinct species.

Viguiera laxa, DC. and V. cordifolia, *Gray, Pl. Wright.* 1, *p.* 107, & 2, *p.* 88, were collected on the Mimbres, by *Dr. Henry.*

Helianthus lenticularis, *Dougl. in Bot. Reg. t.* 1265. On the Canadian; August.

Helianthus petiolaris, *Nutt. in Jour. Acad. Philad.* 2, *p.* 115. Pecan creek, a tributary of the Canadian; August.

Helianthus ciliaris, *DC.* Prairies of the upper Canadian; September. A dwarf state of this well-marked species.

Helianthus rigidus, *Desf.; Torr & Gray, Fl.* 2, *p.* 322. Prairies near Walnut creek, of the Canadian; August.

Helianthus lætiflorus? *Pers.; Torr. & Gray, l. c.* Pecan creek, of the Canadian; August.

Helianthus Maximiliani, *Schrader; Torr. & Gray, l. c.* Prairies and ravines on the Canadian; August.

Helianthus grosse-serratus, *Martens; Torr. & Gray, l. c. p.* 326. Bottoms, Deer creek, Arkansas; August.

Helianthus doronicoides, *Lam.; Torr. & Gray, l. c., p.* 327. On the Canadian, in low places; August.

Actinomers squarrosa, *Nutt. Gen.* 2, *p.* 131. Near Shawneetown, on the Canadian river; August.

Thelesperma gracilis, *Gray in Kew Jour. Bot.* 1, *p.* 252, *& Pl. Wright* 1, *p.* 109. Denuded prairies on the False Washita; August.

Cosmos bipinnatus, var. parviflorus, *Gray, Pl. Wright.* 2, *p.* 90. Plains and pine woods in the mountains near Laguna Blanca; September; (in fruit.)

Bidens chrysanthemoides, *Michx.* San Domingo, New Mexico, in wet places; October.

Bidens tenuisecta, *Gray, Pl. Fendl. p.* 86. Banks of the Pecos; October.

Bidens bipinnata, *Linn.* Hurrah creek, in rocky places; September.

Leptosyne Douglasii, *DC. Prodr.* 5, *p.* 531. San Gabriel and Cocomungo, California; March.

PUGIOPAPPUS, Nov. Gen.

Capitulum, etc., fere Coreopsides; sed flores radii fœminei fertiles; tubus corollæ disci (fauce infundibulari-campanulata haud longior) apice annulatus. Ovaria plano-obcompressa, ovalia, glabra; radii ala angusta cincta, calva; disci marginata, pappo gerentia e squamellis 2 pugioniformibus triquetris, angulis anguste alatis denticulatis, corolla vix dimidio brevioribus, constante. Herba monocarpica, pumila, glabra, subcaulescens, facie Leptosynis; caulibus scapisve sub-1–2-foliatis monocephalis; foliis alternis pinnatisectis, segmentis cum rhachi anguste linearibus; corollis radii et disci flavis.

Pugiopappus Bigelovii. On the Mohave creek, in the desert east of the Colorado; March. The accessions which may be expected are not unlikely to efface the distinctions between several admitted genera, mostly founded on single plants, resembling Coreopsis or Bidens except in having fertile rays. The present plant, which we possess only in an early flowering state, approaches the incompletely-known Narvalina, *Cass.* (a West Indian opposite-leaved shrub) in floral characters, but it could hardly be joined to that genus with our present knowledge. It is to Leptosyne much what Agarista is to some sections of Coreopsis; but it is distinguished by the short tube of the disk-corolla, marked at the summit by a beardless ring, as well as by the pappus; yet, from the analogous case of Coreopsis, one should not be surprised if future discoveries were to connect them.

Heterospermum tagetinum, *Gray, Pl. Fendl. p.* 87. With the preceding.

Sanvitalia Aberti, *Gray, Pl. Fendl. p.* 87, *& Pl. Wright.* 1, *p.* 111. La Cuesta; September.

Ximenesia encelioides, *Cav.* Plains from the Canadian to New Mexico; September.

Verbesina Virginica, *Linn.; Torr. & Gray, Fl.* 2, *p.* 359. Prairies on the Canadian; August.

Flaveria angustifolia, *Pers.; DC. Prodr.* 5, *p.* 635. Sandy bottoms of the upper Canadian; September. In all probability not distinct from F. Contrayerba.

Dysodia chrysanthemoides, *Lagasca; DC. Prodr.* 5, *p.* 640. Plains from the Canadian to the Galisteo, New Mexico; August—October.

Hymenatherum (Aciphyllæa) acerosum, *Gray, Pl. Wright.* 1, *p.* 115. Bluffs of the Llano Estacado; September.

Hymenatherum tenuifolium, *Cass.; Gray, Pl. Wright.* 1, *p.* 118. Bill Williams' fork, West New Mexico; February.

Lowellia aurea, *Gray, Pl. Fendl. p.* 91, *& Pl. Wright.* 1, *p.* 118. Dogtown prairies, on the Llano Estacado, &c.; September.

Gaillardia pinnatifida, *Torr. in Ann. Lyc. New York* 2, *p.* 214; *Torr. & Gray Fl.* 2, *p.* 366. Prairies of the Llano Estacado; September.

Gaillardia pulchella, *Foug.; Torr. & Gray, l. c.* Prairies on the Canadian; September.

Palafoxia Hookeriana, *Torr. & Gray, Fl.* 2, *p.* 368. Sand-hills on the Canadian, from Shawneetown; August–September.

Palafoxia Texana, *DC. Prodr.* 5, *p.* 125. Shawneetown; with the foregoing species.

Chænactis glabriuscula, DC. var. megacephala. Hill-sides and near rivulets, at Knight's ferry, on the Stanislaus, and Ione valley, California; May. Heads from 6 to 9 lines in length. Flowers yellow; the ray-corollas conspicuously ampliate. Pappus mostly of 4 silvery paleæ;

which in the outermost flowers are often oblong, obtuse, and barely half the length of the corolla, but in the others lanceolate, mostly acutish, and almost as long as the corolla. Although the heads are larger than in Douglas' plant, described by De Candolle, and notwithstanding differences in the characters, yet I think that both these specimens and what I called Chænactis filifolia, in *Pl Fendl. p.* 98, belong to C. glabriuscula, *DC.* For, although De Candolle in the generic character assigns 5 or 6 paleæ to the pappus, I find only four in Hooker's, and his own specimens of C. glabriuscula, and these are in many flowers almost as long as the corolla, although in others (probably from the exterior part of the head) they are only half that length, as De Candolle described them. In this and the allied genera, little reliance is to be placed upon the particular size and shape of these paleæ.

Hymenopappus flavescens, *Gray, Pl. Fendl., p.* 97, *& Pl. Wright.* 2, *p.* 94. Dogtown prairies on the Pecos; September. Also, the fine-leaved variety, La Cuesta, New Mexico; September 29.

Hymenopappus tenuifolius, *Pursh, Fl.* 2, *p.* 742; *Torr. & Gray, Fl.* 2, *p.* 372. Plains and dry arroyos from Hurrah creek to the Galisteo; September–October. The characters of all the species need revision. The length of the tube of the corolla and rise of the pappus varies considerably. This species probably includes H. corymbosus, Var. Nuttallii, *Torr. & Gray, l. c.*

Hymenopappus luteus, *Nutt.; Torr. & Gray, l. c.; Gray, Pl. Wright.* 2, *p.* 94. Sandy, denuded plains, on the Upper Canadian; September.

Riddellia tagetina, *Nutt.; Torr. in Emory's Rep. t.* 5; *Gray, Pl. Fendl. p.* 93. Plains, &c., from the False Washita to the Llano Estacado; August–September.

Bahia oppositifolia, *DC. Prodr.* 5, *p.* 656; *Gray, Pl. Fendl. p.* 99; *Torr. in Sitgreaves' Rep. t.* 3. Prairies, &c., near Hurrah creek, N. W. Texas; September.

Bahia (Eriophyllum) confertiflora, *DC. Prodr.* 5, *p.* 657. Hill sides, Sonora, California.

Bahia (Eriophyllum) lanata, *Nutt.; DC. l. c.* California; banks of the Mokelumne river, and near Marysville; May: also, Napa Valley; April: a form with the heads no larger than in B. tenuifolia, DC., but much branched to the top and leafy; the lobes of the leaves rather broad and short, much laciniate and toothed. Knight's ferry, on the Stanislaus; May: the very large form, with the involucre almost half an inch in diameter; the same with Hartweg's No. 1787.

Bahia (Eriophyllum) arachnoidea, *Fisch. & Lallem. Ind. Hort. Petrop.*, 1842; *Gray, Pl. Fendl. p.* 100. B. latifolia, *Benth. Bot. Voy. Sulph. p.* 30. Bolinas Bay, California; April. Pappus reduced to a crown of minute paleæ, shorter than the diameter of the achenium. In a small collection made by Mr. Wm. A. Wallace, in the vicinity of Los Angeles, there is an interesting dwarf Bahia, which, with B. rubella, (an unpublished species found by Dr. Parry in the interior of California,) is intermediate in character between true Bahia and Eriophyllum, and both species are remarkable for having a conical receptacle. The characters are subjoined.

Bahia Wallacei (sp. nov.): annua, humilis, e basi diffusa ramosissima, albo-lanosissima; pedunculis solitariis monocephalis; foliis alternis obovatis vel spathulatis integerrimis; involucro hemisphærico 8-phyllo lanuginoso, squamis subpatentibus margine scariosis discum subæquantibus; ligulis 8 rotundis subintegerrimis aureis; styli fl. disci ramis cono acuto superatis; receptaculo conico; acheniis glabellis; pappi paleis 10 brevissimis enerviis obtusissimis. Teyunga, near Los Angeles, California; May; *Mr. Wm. A. Wallace.* Plant 2 or 3 inches high, but doubtless acquiring a greater size later in the season, white, with a dense covering of long and loose floccose wool, the branches terminated by peduncles of about an inch in length. Leaves numerous, 3 to 6 lines long, tapering into a slight petiole. Involucre $2\frac{1}{2}$ lines long and broad; the scales obovate-oblong, acute, membranaceous, with a hyaline margin. Ligules $1\frac{1}{2}$ to 2 lines in length and breadth, either retuse or obsoletely emarginate, three-toothed at the truncate-summit, abruptly contracted at the base into a very short tube. Disk-flowers, 20 or more, like those of true Bahia. Branches of the style much as in Bahia ambrosioides, but with a proportionately larger, triangular, more flattened, acute, and hispid cone or appendage.

Paleæ of the pappus oblong, or the alternate ones oval, about one-sixth of the length of the corolla, scarcely longer than the breadth of the achenium. Receptacle proportionately large, ovoid-conical.

I append the characters of what must be regarded as a new genus, allied to Bahia, Burrielia, and Actinolepis, and remarkable for its multisetose rather than paleaceous pappus.

SYNTRICHOPAPPUS, Nov. Gen.

Capitulum multiflorum, heterogamum; floribus radii 5 ligulatis fœmineis; disci tubulosis hermaphroditis. Involucrum obovatum, e squamis 5 erectis membranaceis discum æquantibus. Receptaculum convexum, nudum. Corollæ glabræ; disci infundibuliformes, limbo quinquelobo, lobis lineari-oblongis; ligulæ breves, late ovales, apice trilobæ. Antheræ lineares, in appendicem lanceolatam longe productæ. Styli rami fl. disci appendice triangulata complanata hispidula conspicua superati. Ovaria oblongo-linearia, hirsuta. Pappus (radii et disci conformis) e setis plurimis (35–40) uniserialibus filiformibus hispidulis æqualibus basi inter se pl. m. coalitis constans, corolla disci paullo brevioribus. Herba monocarpica, e basi ramosa, depressa, floccoso-lanata, deinde glabrescens; foliis alternis cuneato-spathulatis apice trilobatis; capitulis breviter pedunculatis; floribus flavis.

Syntrichopappus Fremontii. (Tab. XV.) Gathered by Colonel Fremont (a single specimen) in his journey across the continent in 1853–4, probably in the spring of 1854, and somewhere between the Rocky Mountains and the Sierra Nevada. A small herb, intermediate in habit between Actinolepis, DC., and Bahia § Trichophyllum. Leaves 6 to 10 lines in length, tapering from the summit into a long, narrowed base. Heads somewhat glomerate on the branches, 3 lines long. Scales of the involucre concave, with narrow scarious margins. Pappus white, composed of 30 to 40 uniform and equal slender bristles, which are all usually connate at the very base into a ring, so as to fall away together; and also for the most part further united in twos, threes, &c.; the combined base somewhat paleaceous.

Amblyopappus Neo-Mexicanus. Schkuhria (Amblyopappus vel Achyropappus ligulus nullis) Neo-Mexicana, *Gray, Pl. Fendl. p.* 96. Hills and rocky places near La Cuesta, &c., between the Pecos and the Rio Grande; September. The same as Fendler's No. 458. Except in the want of rays, this is an Achyropappus; the species of which (along with an unpublished one, gathered by Dr. Bigelow on the Limpio, in 1852, Bahia (Achyropappus) Bigelovii) I am unable to keep generically separate from true Bahia. Its characters accordingly associate it with Amblyopappus, *Hook. & Arn.* (Aromia, *Nutt.;* Infantea, *Remy,*) which may perhaps be kept distinct for the sake of convenience, unless, as is likely, radiate and rayless heads should occur in the same plant.

Villanova chrysanthemoides, *Gray, Pl. Wright* 2, *p.* 96. Rocky places near Hurrah creek; September. In a few heads some traces of a chaffy pappus were detected, showing that this is really only an epappose Bahia.

Monolopia major, *DC. Prodr.* 6, *p.* 74. A small form, Napa valley, Feather river, &c., California; May.

Monolopia lanceolata, *Nutt. Pl. Gamb. in Jour. Acad., Philad., n. ser.* 1, *p.* 175. Los Angeles, California; March. This comes from the same district as Nuttall's M. lanceolata, and was likewise gathered by Coulter, (No. 323.) The leaves are lanceolate, nearly all toothed, and less woolly than those of M. major; but the lowest are opposite, and the scales of the involucre are united to about the middle.

Lasthenia (Hologymne) glabrata, *Lindl.; DC. Prodr.* 5, *p.* 665. Near Tamul-Pass Mountain, California; April 11.

Burrielia (Baeria) chrysostoma, *Torr. & Gray, Fl.* 2, *p.* 379; and var. macrantha. San Francisco; the variety on hills near Punta de los Reyes, California; April. The stems, foliage, &c., of the variety accord with the larger states of Burrielia chrysostoma; but the head is of extraordinary magnitude, the involucral scales being half an inch, and the rays an inch in length.

Burrielia tenerrima, *DC. Prodr.* 5, *p.* 663. Cocomungo, California; March. In the same head some of the flowers present a pappus of a single large palea, (awned from a broad base;) others have a minute rudiment of a palea, the greater number none at all; thus destroying all claims of Baeria to rank as a genus. Perhaps the epappose state of more than one Burrielia may have been referred to B. chrysostoma.

Burrielia (Dichæta) lanosa (sp. nov.):. pygmæa, arachnoideo-lanata, foliosa; foliis linearibus plerumque integerrimis; capitulo sessili; involucri squamis oblongis ligulisque ovalibus (albis?) 8; antheris appendice setiformi auctis; pappo ex aristis 4 subulatis scabris corolla paullo brevioribus et squamis totidem oblongis obtusis denticulatis alternantibus. Gravelly hills near the Colorado of the West; February. The specimens are barely an inch high from a slender annual root, leafy to the head, and clothed throughout with a loose white wool. They are evidently early seedling plants, flowering at the first approach of spring, but probably branching and increasing considerably in height as the season advances. They were found growing along with equally pigmy specimens of Eremiastrum bellidioides. Perhaps the wool is deciduous with age. Leaves half an inch long, tapering downwards, one of them is two-lobed at the apex. Involucre campanulate, two and a half or three lines long, resembling that of a Bahia Eriophyllum. Ligules two lines long, broadly oval, truncate and emarginate or three-toothed at the summit. Disk-flowers yellow. Anthers tipped with a setiform appendage almost of their own length. The intermediate paleæ of the pappus almost half the length of the aristiform ones, which are about two-thirds the length of the disk-corolla. Ovaries linear, minutely hairy.

Helenium autumnale, *Linn.* Springs and wet places on the upper Canadian; September. A roughish and rigid-leaved state.

Helenium Mexicanum, *H. B. K. Nov. Gen. & Spec.* 4, *p.* 299; *DC. Prodr.* 5, *p.* 666. Bolinas Bay, California; April. The same as No. 357 of Coulter's California collection. The pappus is from a third to half the length of the disk-corolla, as it is in Humboldt's plant.

Helenium Bigelovii (sp. nov.): subglabrum; caule bipedali simplici apice longe nudo monocephalo vel superne parce ramoso; ramis monocephalis; foliis lineari-lanceolatis integerrimis parallele triplinerviis basi plerumque in caulem decurrentibus; ligulis palmatifidis involucri squamis subulatis et disco hemisphærico paullo longioribus; pappi paleis 5–7 ovato-lanceolatis aristatis corolla 5-dentata tertia parte breviore. Swamps near Santa Rosa Creek, California; May. Plant, when single-stemmed and simple, with much the aspect of a Leptopoda and of Hecubæa; the striate stem moderately leafy below, its naked summit or peduncle 10 or 12 inches long, thickened under the head. One specimen, however, is considerably branched above. Leaves from 3 to 6 inches long, 3 to 5 lines wide, erect, tapering to each end; the lower ones again dilated at the insertion, and mostly decurrent on the stem into a slight or manifest wing; the radical leaves similar, or rather shorter and broader. Rays numerous and crowded, bright yellow. Disk two-thirds of an inch in diameter, between hemispherical and depressed-globose, as is the receptacle, considerably larger than in any form of H. autumnale, but the rays not so long in proportion. This handsome and well-marked species is dedicated to the discoverer.

Actinella Richardsonii, *Nutt. in Trans. Amer. Phil. Soc. l. c.; Gray, Pl. Fendl. p.* 101. Pine and Cedar woods near Galisteo, New Mexico; October.

Actinella leptoclada, (sp. nov.): caulibus e caudice perenni crasso multicipiti gracilibus ramosis foliosis; ramis apice longe nudis monocephalis; foliis lineari-spathulatis, radicalibus in petiolum attenuatis subtrinerviis subtus vel utrinque sericeo-canescentibus, superioribus viridulis; involucri squamis biserialibus oblongis cano-villosis; receptaculo acute conico; pappi paleis 5 obovato-rotundis integerrimis subito longiuscule aristatis. In mountains and rocky places near Santa Antonita, New Mexico; October. Caudices 1 or 2 inches long, cespitose, clothed with the scaly bases of former leaves mixed with villous hairs, as in other species; the slender and loosely-branched flowering stems 8 or 9 inches high, 4–6-leaved. Leaves 1 or 2 inches long, $1\frac{1}{2}$ to 3 lines wide, the radical often spatulate and silky-canescent, at least beneath, nearly as in A.

acaulis, but the cauline or upper ones green and merely silky-pubescent, strongly punctate. Peduncles or naked branches 3 to 4 inches long, almost filiform. Head small, the involucre barely 3 lines in diameter. Rays 5 to 8, glandular-puberulent underneath. Pappus similar in the disk and ray; the thin silvery scales very obtuse, marked with an indistinct mid-nerve, which is abruptly produced into a slender awn rather shorter than they, and a little shorter than the disk-corolla. Achenia silky-villous. The perennial root, thick caudices, and broader leaves, the lower at least appressed-silky and canescent, distinguish this from any form of A. linearifolia; the much smaller heads, the less silvery foliage, the acute receptacle, and the rounder paleæ of the pappus forbid its being viewed as an attenuated form of A. argentea.

Actinella acaulis, *Nutt. l. c.; Torr. & Gray, Fl.* 2, *p.* 389. On the crest of the Sandia mountains, New Mexico; October 10. The scape, 2 or 3 inches long, and seldom exceeding the linear silvery radical leaves, occasionally bears one or two similar leaves.

Actinella scaposa, var. A glabra, *Nutt. l. c.; Torr. & Gray, l. c.* Rocky ridges of the Antelope hills, on the Canadian; September. This is the same as the A. scaposa var. mutica, *Gray, Pl. Fendl. p.* 101; and the pappus is sometimes awnless, sometimes short-awned. It is without doubt the A. glabra of Nuttall, (whose specimen probably came from the same district, not from the Missouri,) but only a narrow-leaved and glabrate form of A. scaposa.

Achyrachæna mollis, *Schauer; DC. Prodr.* 7, *p.* 492. On plains, Benicia and Ione valley, California; April–May.

Layia Calliglossa, *Gray, Pl. Fendl. p.* 103. Calliglossa Douglasii, *Hook. & Arn. Bot. Beech. p.* 356. Fields at Benicia, California; April.

Layia (Calichroa) platyglossa, *Gray, l. c.* San Francisco and Los Angeles, California; March–April.

Layia (Callichroa) pentachæta, (sp. nov.): villoso-hispida; foliis linearibus, inferioribus parce pinnatifidis, superioribus integerrimis; pappo ex aristis 5 tenui-setiformibus lævibus ter se æqualibus achenio pubescente et fere corolla æquilongis. (Tab. XVI.) Hillsides at Knight's ferry, on the Stanislaus, California; May. This adds another to the already numerous species of this genus, which so closely resemble one another that they can scarcely, if at all, be distinguished, except by the pappus, or sometimes by the chaff of the receptacle. The present species falls naturally into the section Callichroa, and is only to be distinguished from the more slender forms of L. platyglossa, perhaps, by the rather smaller heads and less hairy achenia, but principally and surely by its pappus of only five longer and smooth awns. These are slender and bristle-like, naked, and only obscurely denticulate under a strong lens. Receptacle chaffy only at the very margin. Rays cuneate, yellow throughout.

Layia (Madaroglossa) gaillardioides, *Hook. & Arn. Bot. Beech. p.* 148 *& p.* 357. Napa Valley and Tamul Pass, California; April. This is undoubtedly Hooker and Arnott's species, on which the genus was originally founded. But there is seldom any chaff on the receptacle within the exterior disk flowers, so that it wholly falls into the section Madaroglossa. Its large rays trifid at the apex distinguish it from L. hieracioides. The fuscous pappus is villous with rather scanty wool only next the base.

Layia (Madaroglossa) carnosa, *Nutt. in Trans. Amer. Phil. Soc.* 7, *p.* 393, *& in Torr. & Gray, l. c.* Sandy beach, Punta de los Reyes, California; April.

Layia (Madaroglossa) heterotricha, *Hook. & Arn., l. c.; Hook. Ic. Pl. t.* 326. Plains at Knight's Ferry, on the Stanislaus, California; May.

Lagophylla dichotoma, *Benth. Pl. Hartw. p.* 317. Plains of Feather river, near Marysville, California; May. The rays are bright yellow. The genus is distinguished from Hemizonia by the obcompressed fertile achenia, completely enclosed by the subtending involucral scale, and by the cuneiform, deeply trifid rays. The habit also is peculiar. Yet the genus may perhaps pass into Hemizonia, although it is more distinct from it than Calycadenia is.

Hemizonia luzulæfolia, *DC. Prodr.* 5, *p.* 692. Hillsides near Benicia, California; April.

Hemizonia Fitchii (sp. nov.): annua, pilis longissimis patentibus arachnoideo-villosa; caule rigido erecto superne demum ramoso; foliis caulinis elongatis pinnatifidis vel pinnatipartitis, (imis nunc fere bipinnatipartitis,) summis et ramealibus subulato-linearibus integerrimis seu rariter dentatis rigidis pungenti-cuspidatis, floralibus capitulum sessile arcte involucrantibus et bis superantibus; involucri squamis 7–9 subulatis glandulis nonnullis parvis claviformibus obsitis ligulis oblongis apice bidentatis flavis paullo brevioribus; floribus disci (plusquam 30) omnibus paleis receptaculi oblongis scariosis muticis ad apicem herbaceum longe crinitis fulcratis; pappo (fl. disc. ster.) corollam subæquantibus e paleis 8–12 auguste linearibus rigidis basi in tubum vel in phalanges sæpius pl. m. coalitis superne fimbriato-barbatis; ovariis radii apice valde gibbosis. Plains of the Sacramento, California; May; where it was previously detected by the Rev. Mr. Fitch. A well-marked and peculiar species, which will fall into none of the sections of the genus, as they are limited in the Flora of North America; but in some respects it approaches that section of Calycadenia which is formed of Nuttall's Osmadenia, and of which some additional species are now known. The present plant has a rigid and usually stout stem, from three to twelve inches high, at first simple, and terminated by a single sessile head, (of about an inch in diameter,) at length corymbosely branched, often from within the circle of involucrate leaves, so as to appear proliferous. Cauline leaves of linear outline, two to three inches long; the rigid and springy-pointed rameal ones an inch or less in length, often fascicled. Ligules three lines long, including the tube. Lobes of the disk-corolla short, ovate. Receptacle chaffy throughout; the paleæ distinct, partly wrapped around the disk-flowers. The very immature fertile achenia are obovate-trigonal, with a short inflexed stipe, a large dorsal hump, and a short inflexed apical beak.

Hemizonia congesta, *DC. Prodr.* 5, *p.* 692. California. Besides these specimens, I have seen no indigenous ones except those of Douglas, who seems to have collected it sparingly. I have, however, a specimen taken from a plant raised in the Cambridge Botanic Garden, in 1850, from seeds received the previous year from the London Horticultural Society, under the name of "Madaria corymbosa." Indeed, it is distinguishable from Madaria by the shape of the fertile achenia alone. The foliage and young parts are more cinereous and soft-downy than in Madaria, and many of the leaves are serrulate-toothed.[1]

Madaria elegans, *DC. Prodr.* 5, *p.* 692. Hill-sides, Knight's Ferry, on the Stanislaus River; May.

Madia sativa, *Molina; DC., l. c.* With the preceding, and in Napa Valley.

Madia racemosa, *Nutt. in Trans. Amer. Phil. Soc.; Torr. & Gray, Fl. N. Amer.* 2, *p.* 405. Hill-sides, with the preceding.

Harpæcarpus madarioides, *Nutt., l. c.; Torr. & Gray, Fl. N. Amer.* 2, *p.* 406. Hill-sides, Napa Valley; April: a small form; and Knight's Ferry; May: a larger state.

Calycadenia cephalotes, *DC. Prodr.* 5, *p.* 695; also, C. multiglandulosa, *DC. l. c.*, which is a more elongated and glandular state. Hill-sides and plains, Knight's Ferry, on the Stanislaus; May.

Maruta Cotula, *DC. Prodr.* 6, *p.* 13. Knight's Ferry, on the Stanislaus, California; May. Doubtless introduced.

Achillea Millefolium, *Linn.* Stony mountain streams, New Mexico; October: Benicia, California; April.

Baileya pleniradiata, *Harv. & Gray, in Pl. Fendl. p.* 106. Gravelly hills and arroyos, New Mexico; October–November.

Baileya multiradiata, *Harv. & Gray, l. c.; Torr. in Emory, Rep. p.* 144, *t.* 6. Williams' River; February.

Matricaria discoidea, *DC. Prodr.* 6, *p.* 52. Corte Madera, California; April.

[1] Hemizonia filipes, Hook. & Arn., is doubtless a third Lagophylla, L. filipes. Hartmannia ciliata, *DC.*, is surely Oxyura chrysanthemoides. There is no specimen in the Candollean herbarium; whence I suppose that De Candolle had discovered the fact and united the specimens, but omitted to erase the species under Hartmannia from his manuscript.

Cotula coronopifolia, *Linn.; DC. l. c. p.* 78. Swampy places, Benicia, California; April. Laguna, near San Francisco, *Mr. H. G. Bloomer.* Dr. Bigelow does not seem to have thought this an introduced plant; but it was probably brought to California from the Old World.

Artemisia dracunculoides, *Pursh., Fl.* 2, *p.* 742; *Torr. & Gray, Fl.* 2, *p.* 416. Rocky hills along the Canadian River; August.

Artemisia caudata, *Michx. Fl.* 2, *p.* 129. Sandy bottoms of the Canadian; September.

Artemisia filifolia, *Torr. in Ann. Lyc. New York* 2, *p.* 211, *& in Marcy's Rep. t.* 12. Rocky hills on the Canadian; August.

Artemisia Bigelovii (sp. nov.): fruticosa, humilis, incana; foliis utrinque albo-sericeis cuneato-linearibus seu augustissime cuneatis apice tridentatis, floralibus parvis integerrimis; capitulis obovatis parvis glomeratis longe spicato-paniculatis; involucro tomentoso sæpissime trifloro; floribus 2 hermaphroditis, unico fœmineo; corolla glabra. Rocks and cañons on the Upper Canadian and Llano Estacado. A much branched, shrubby species, apparently only a foot high, and of the section Abrotanum; very canescent all over, the crowded leaves and branchlets with a fine and close silvery sericeous pubescence, the heads (which are glomerate, into a strict and virgate, interrupted, spicate panicle, of fully the length of the leafy branches) more tomentose. Leaves 3 to 7 lines long, 1 to 2 lines broad at the truncate and 3-toothed or 3-lobed apex, thence tapering to the base, equally silky-canescent on both sides, the broader ones triplinerved above; the floral ones very small, filiform-linear, entire, scarcely as long as the glomerules they subtend. Heads a line and a half long, usually three-flowered, sometimes only two-flowered, but one of them always slender and pistillate only, apparently all of them fertile. Scales of the involucre oblong, obtuse; the exterior with slight scarious margins, the innermost scarious, villous-ciliate. This might be mistaken for a small and narrow-leaved state of A tridentata, *Nutt.;* but the heads are smaller, more hoary, fewer-flowered, and heterogamous, while in that species (rightly referred to the section Seriphidium) the flowers are all hermaphrodite.

Artemisia Ludoviciana, *Nutt.:* an entire-leaved variety. Hills and plains, with the last species.

Artemisia frigida, *Willd.; DC. Prodr.* 6, *p.* 125. La Cuesta, New Mexico; on mountains and plains; September.

Filago parvula, *Torr. & Gray, Fl.* 2, *p.* 432. Hill-sides, Napa Valley, California; April. Plant a span to nearly a foot high, the fascicles of capituli terminating the corymbose branches. Involucral scales and chaff mostly obtuse, the exterior with a narrowed apex.

Antennaria luzuloides, *Torr. & Gray, Fl.* 2, *p.* 430: var. foliis inferioribus oblongo-spathulatis. A. argentea, *Benth. Pl. Hartw. no.* 1810, *p.* 319. Duffield's Ranch, in the Sierra Nevada, California; May. The male plant only. Stem 12 to 18 inches high. Scales of the involucre either white or tinged with rose-color.

Gnaphalium Californicum, *DC. Prodr.* 6, *p.* 224. San Francisco. Punta de los Reyes; April. San Gabriel; March.

Gnaphalium Sprengelii, *Hook. & Arn.* Between the upper Canadian and the Rio Grande, New Mexico. Cocomungo, California; March.

Gnaphalium palustre, *Nutt.; Torr. & Gray, Fl.* 2, *p.* 427. Knight's Ferry, Stanislaus River, California; May; on the sides of rivulets. Albuquerque, New Mexico; October: the variety with smooth achenia.

Gnaphalium purpureum, *Linn.* San Francisco; April.

Gnaphalium microcephalum, *Nutt.; Gray, Pl. Wright.* 1, *p.* 124. Rocky places. Hurrah Creek, New Mexico; September.

Gnaphalium strictum (sp. nov.): annuum, cano-lanatum; caule simplici stricto; foliis angustissime linearibus elongatis; capitulis in axillis arcte glomeratis; glomerulis subsessilibus folioso-bracteatis foliis multo brevioribus longe interrupto-spicatis; involucro campanulato, squamis exterioribus lanceolatis subfuscis, intimis linearibus apice albidis; acheniis lævibus.

Banks of the Rio Grande, near Albuquerque; October. Stems 3 to 9 inches high, virgate. Leaves uniform from the base to the apex of the stem, an inch or an inch and a half long, rather crowded, almost filiform. Heads rather larger than those of G. uliginosum, densely congested into woolly capitate glomerules, one in each axil, and forming a long and virgate, interrupted, leafy spike. Flowers very numerous. Receptacle broad and flat. Involucre about the length of the disk. To this apparently well-marked species belongs a specimen gathered by Frémont, in his first expedition, on the Sweet-water of the Platte. Its strict and virgate stems and inflorescence, and the very narrow leaves, distinguish it at once from G. uliginosum and any allied species.

Senecio filifolius, *Nutt.* var. Jamesii, *Torr. & Gray, Fl.* 2, *p.* 444; and var. Fremontii, *Torr. & Gray, l. c.* Rocky hills of the Upper Canadian; September.

Senecio longilobus, *Benth. Pl. Hartw.* var. Rocky places, Hurrah Creek, New Mexico; September.

Senecio Fendleri, *Gray, Pl. Fendl. p.* 108. Sandia mountains, New Mexico; October. The specimens exactly accord with those of Fendler's collection.

Senecio eremophilus, *Richards.; Gray, Pl. Fendl. p.* 108. Mountain arroyos, near Santa Antonita, New Mexico; October.

Senecio eurycephalus, *Torr. & Gray, Pl. Fendl. p.* 109, var. major; foliis tantum pinnatifidis, radicalibus superne integris inferne dentatis rariter laciniato-lobatis. On plains, near Murphy's, California; May. The heads and flowers accord with those of Frémont's and Hartweg's specimens of S. eurycephalus; but the plant is larger, apparently 3 or 4 feet high; the cauline leaves are 6 to 9 inches long, lanceolate in outline, obtuse, laciniate-pinnatifid, with irregular and unequal oblong lobes; the radical leaves oblong or ovate-oblong, sparingly and irregularly pinnatifid only at the base. All these species may be expected to be polymorphous in foliage.

Senecio exaltatus, *Nutt.; Torr. & Gray, Fl.* 2, *p.* 439. Hill-sides, near Downieville, California; May.

Senecio exaltatus, Nutt., var. uniflosculus. Hill- ides, Grass Valley, California; May. A slender form, and with a solitary ray, or sometimes perhaps rayless.

Senecio aronicoides, *DC. Prodr.* 6, *p.* 426. Hills, near San Francisco and Punta de los Reyes; April. Also, with slightly-toothed leaves and few heads, Duffield's Ranch, in the Sierra Nevada; May.

Senecio Californicus, *DC. l. c.*, var. foliis caulinis laciniato-pinnatifidis. Cocomungo, California, in sandy plains; March. This appears to differ from S. Californicus, *β. DC.*, only in the laciniate-pinnatifid or toothed leaves. The heads are larger than in Nuttall's S. Coronopus.

Senecio Bigelovii (sp. nov.): glabra; caule simplici e radice perenni apice racemoso-3–15-cephalo; foliis ovato-lanceolatis acuminatis argute calloso-dentatis in petiolum longum marginatum contractis, supremis lanceolatis basi augusta semiamplexicaulibus; capitulis magnis nutantibus homogamis; involucro late campanulato 10–12-phyllo basi bracteolis paucis brevibus setaceis calyculato, squamis acutis æqualibus, exterioribus lanceolatis, interioribus latioribus scarioso-marginatis; ligulis nullis; acheniis glaberrimis. In mountain arroyos, near Camp Douglas, New Mexico; October. Plant entirely glabrous. Stem rather stout, erect, 18 inches to 2 feet or more in height, rather leafy to the top; the uppermost leaves reduced to bracts. Lower leaves 3 to 5 inches long, abruptly contracted at the base into a margined or winged petiole of 2 or 3 inches in length; the upper successively narrower and with shorter petioles, or at length sessile. Heads racemose, nodding on the summit of erect and naked or slightly bracteolate peduncles of $1\frac{1}{2}$ to 3 inches in length, very large for a Senecio, from half to three quarters of an inch in length and breadth, many-flowered. Involucre rather fleshy, a little shorter than the flowers, very minutely bracteolate; the scales 5 or 6 lines long, herbaceous, with abrupt hyaline-scarious margins, which on the alternate and interior scales are broad and

conspicuous. Corollas yellow, narrowly infundibuliform-tubular, rather deeply 5-toothed at the summit, externally callous-thickened, and reticulated at the tip. Stamens, style, &c., as in Senecio. Achenia linear, perfectly glabrous, strongly ribbed or angled, fully 3 lines long. Pappus soft and fine, white, minutely scabrous. This striking species may perhaps be taken for a Cacalia; but I see nothing to distinguish it from Senecio. There is no North American species with which I can compare it, except S. Frémontii, *Torr. & Gray*, which has much smaller and radiate heads.

Haploesthes Greggii, *Gray, Pl. Fendl. p.* 109. Gypsum hills, on the Upper Canadian; September.

Cirsium undulatum, *Spreng.; DC.; Torr. & Gray, Fl.* 2, *p.* 456. Plains of the Upper Canadian to Anton Chico, in the mountains; September.

Cirsium altissimum, *Spreng.; Torr. & Gray, l. c.* Woods, near Shawneetown; August. "Stem 10 feet high."

Cirsium Californicum (sp. nov.): elatum, ramosum; foliis caulinis lanceolatis basi subdecurrentibus infra medium sinuato-pinnatifidis denticulatis spinulosis supra glabris vel glabratis subtus ramisque arachnoideis; capitulis longe pedunculatis hemisphæricis; involucro ebracteato glabrato, squamis subulato-lanceolatis superne subfoliaceis patulis spinula brevi cuspidatis. Hill-sides, near Knight's Ferry, on the Stanislaus, California; May. Only the upper part of an apparently tall plant was collected. The largest leaves (upper cauline) are 5 or 6 inches long, an inch wide, obtusely sinuate-pinnatifid from the middle to the base, the summit entire; the upper surface green, sparingly arachnoid when very young, soon glabrous and smooth, the lower clothed with a thin and whitish arachnoid wool, not more dense than that of C. lanceolatum. Heads solitary, terminating nearly naked branches or peduncles of 5 to 8 inches long, erect, rather smaller than those of C. lanceolatum. Scales of the involucre occupying only about five series, slightly arachnoid, soon glabrous, smooth; the coriaceous base appressed; the upper half of all except the innermost spreading, and more or less green, narrow, tapering into a small prickle of not more than two lines in length. Flower apparently pale purple or pink. Pappus not very copious, 7 lines long.

Onopordon Acanthium, *Linn.?* San Francisco; April. The heads undeveloped.

Silybrum Marianum, *Gærtn.* Stanislaus River, near Knight's Ferry, California; May. A single specimen occurs in the collection; its ticket has no indication of the plant being otherwise than indigenous; but it was doubtless introduced from the south of Europe.

Perezia nana, *Gray, Pl. Fendl. p.* 111, *& Pl. Wright.* 1, *p.* 125. Plains, near Laguna Colorado, New Mexico; September.

Calais macrochæta, *Gray, Pl. Fendl. p.* 112, *adn.** San Francisco, California; April. The

*The recent accessions to this group of plants render the union of Seorzonella, *Nutt.* and Ptilophora, *Gray, Pl. Fendl. l. c.*, with calais inevitable, as will be seen by the following synoptical view:

CALAIS, *DC. Prodr.* 7, *p.* 85, char. auct.

Capitulum multi-(rarius pauci)-florum. Involucrum cylindraceum vel campanulatum, aut simplex basi calyculatum, aut imbricatum pauciseriale. Receptaculum epaleaceum planum. Achenia teretia, 10–14-costata, aut erostria aut sursum rostrato-attenuata. Pappus simplex, e palcis seariosis aristatis 5–10 vel 14–22, aristis scabris barbellatis vel plumosis. Herbæ Americæ Boreali-Occidentalis, scapis ramisvo superne longe nudis monoeephalis, floribus flavis.

§ 1. Calocalais, *DC.* Achenia gracilia, apice attenuata vel breviter rostrata. Pappus (sæpissime niveus) e paleis 5 apice bifidis ex sinu aristam nudam proferentibus. Involucri squamæ exteriores breviores. Ligulæ breves vix exsertæ. Monocarpicæ, leptorhizæ, subcaulescentes.

1. C. linearifolia, *DC. l. c.*, exel. syn. C. Lindleyi, *DC.*

2. C. macrochæta, *Gray, Pl. Fendl. p.* 112, excl. syn.

3. C. Parryi (sp. nov.): scaposa, fere glabra; involucri squamis triseriatis ovatis oblongisve subobtusis, exterioribus graduatim brevioribus; pappi paleis oblongis apice bifidis arista e sinu exserente barbellato-seabra dimidio brevioribus. Near San Diego, California, *Dr. Parry.* (Aehenia not seen.)

§ 2. Eucalais, *DC.* Achenia breviora, linearia vel oblonga basi attenuata, erostria, apice truncata, extima villosa. Pappus (sordidus vel rufidulus) e paleis 5 integris in aristam barbellato-scabram productis. Involucrum basi calyculatum; squamæ propriæ inter se æquales. Ligulæ breviusculæ, exsertæ. Monocarpicæ, leptorhizæ, seaposæ.

4. C. Douglasii, *DC. l. c.*

specimens are barely in flower, and therefore too young for ascertaining the form of the achenia. But the pappus and the lanceolate very taper-pointed involucral scales are just as in C. macrochæta, and the whole plant resembles the Oregon specimens, except that the leaves are mostly pinnatifid with longer linear lobes; a character of no specific value in this and other Cichoraceous genera, and not uniform in these specimens. These plants, like so many others of the same and similar regions, spring from seed apparently in the autumn, and flower in the vernal season; so that one is in doubt whether to call them annuals or biennials, between which there is no marked distinction in such climates.

Calais Douglasii, *DC. Prodr.* 7, *p.* 85. Low or wet places, Mark West's creek, California; April. A depauperate state, with slender and only about 10-flowered heads, none of the exterior achenia hirsute. Still the few specimens gathered (mixed with another species) cannot safely be regarded as specifically distinct from C. Douglasii.

Calais Bigelovii (sp. nov.): scaposa, spithamæa; foliis pinnatipartitis, lobis plerumque crebris linearibus acutis, majoribus sæpe laciniatis; involucro calyculato; acheniis oblongo-turbinatis apice truncatis, (nec rostratis nec sursum angustatis,) externis villosissimis; pappi paleis 5 oblongo-ovatis in aristam barbellulatam iisdem longiorem subito productis. (Tab. XVII.) Corte Madera, California; April. This species is most nearly related to C. Douglasii; but the heads are smaller and shorter; the (ovate-lanceolate) scales of the involucre broader; the achenia barely 2 lines long when apparently full grown, and tapering from the broad truncate summit to the base, the exterior densely villous, the others smooth, or nearly so; the fuscous paleæ of the pappus are of nearly the length of the achenium, their strong midnerve produced abruptly from the apex into an arwn, which is about a third longer than the palea itself.

Calais cyclocarpha (sp. nov.): scarpsra, glaberrima; foliis scapis dimidio brevioribus integris et pinnatifidis, lobis integerrimis; involucro calyculato; acheniis oblongis sub apice truncato levissime contractis, extimis villosissimis; pappi paleis 5 orbiculatis integris achenio dimidio arista barbellulata circiter triplo brevioribus. (Tab. XVIII.) Napa Valley, California, on grassy plains and hill-sides; May. Root annual, slender, as in all the species of true Calais. Leaves 5 to 9, the naked scapes 6 to 18, inches long. Involucre 5 to 6 inches long, campanulate, glabrous, of 10 or 11 ovate-lanceolate equal proper scales, and of 6 or 7 very short

5. C. Bigelovii, sp. nov. Vide supra.

6. C. cyclocarpha, sp. nov. Vide supra.

7. C. platycarpha (sp. nov.): pappi paleis latissime ovalibus integerrimis brevissime aristatis. San Luis Rey, California, *Dr. Parry.*

§ 3. Aphanocalais. Achenia clavato-oblonga, erostria, apice obtuso areola parva terminata! omnia glabra. Pappus Scorzonellæ, sed paleis multum paucioribus (1–5) et deciduis, quandoque nullus! Involucrum fere Eucalaidis, 8–12 florum. Ligulæ exsertæ. Herbula scaposa monocarpica, radice exili.

8. C. tenella, sp. nov. Vide supra, p. 112.

§ 4. Scorzonella. (Scorzonella, *Nutt.*) Achenia brevia, truncata, hand apice vix basi angustata. Pappus e paleis 10 brevissimis lato-ovatis integerrimis, arista capillari scabro-denticulata multoties brevioribus, constans. Involucri squamæ gradatim imbricatæ, acuminatæ. Caules subramosi plures, e radice perenni tuberosa fusiformi.

9. C. laciniata. Hymenonema? laciniatum. *Hook. Fl. Bor.-Am.* 1, *p.* 301 Scorzonella laciniata and S. leptosepala? *Nutt. in Trans. Amer. Phil. Soc. n. ser.* 7, *p.* 426; *Torr. & Gray, Fl.* 2, *p* 470. Hymenonema? glaucum, *Hook. l. c.*, (Scorzonella glauca, *Nutt. l. c.*,) is either an allied species, or only an entire-leaved state of C. laciniata.

§ 5. Anacalais. Achenia linearia, erostria, omnia glabra. Pappus (sordidus) e palcis 6–9 vel sæpissime 10 lanceolatis integerrimis in aristam longam barbellatam desinentibus. Involucri squamæ subgradatim imbricatæ, acuminatæ. Ligulæ exsertæ, elongatæ. Caulis simplex e radice bienni? gracili vel subfusiformi, basim versus foliosus.

10. C. sylvatica. Vide supra, p. 112. Scorzonella sylvatica, *Benth. Pl. Hartw. p.* 320.

§ 6. Ptilophora. (Ptilophora, *Gray*, non *Kutzing.*) Achenia oblongo-linearia, erostrata. Pappus (albus) e paleis 14–22 brevissimis aristam prælongam molliter plumosam gerentibus. Involucri squamæ inæquales, extimæ brevio. es. Ligulæ exsertæ. Caules ramosi, e radice perenni fusiformi vel tuberosa.

11. C. nutans. Crepis nutans, *Geyer.* Ptilophora nutans, *Gray, Pl. Fendl. p.* 113.

12. C. major. Ptilophora major, *Gray l. c.*

This last group has greater claims than any of the preceding to rank as distinct from Calais, but too close a transition is found in section 5. The name *Ptilophora* is preoccupied in the Algæ. Still it may serve to designate a subgenus in the present instance; otherwise the latter may be called *Ptilocalais.*

and small calyculate ones. Flowers numerous. Achenia only 3 lines long, terete and strongly 10-ribbed in the manner of the genus, narrowed at the base, very slightly contracted underneath the large and truncate summit, the inner ones scabrous on the ribs. Paleæ of the pappus of a firm scarious texture, overlying each other in a convolute manner, or else imbricated, a line and a half long, and of equal breadth, whitish, appressed-puberulent or scabrous externally (at least the exterior ones) as in Eucalais generally, entire, or erose-denticulate near the summit, where the thick midnerve is abruptly produced into a long and rather stout arwn. This is well distinguished by the pappus, &c., from any one yet described, and is most nearly related to an unpublished species (C. platycarpha) found by Dr. Parry at San Luis Rey, of which better materials are wanted, but which appears to be clearly distinguished by the larger paleæ of the pappus, tipped with very short arwns. Both in the achenia and the pappus C. cyclocarpha makes an approach to Scorzonella.

Calais (Aphanocalais) tenella (sp. nov.): annua, scaposa, fere glabra; foliis linearibus integerrimis et laciniato-pinnatifidis scapo filiformi subæquilongis; capitulo 8–12-floro; involucro calyculato, squamis lanceolatis obtusiusculis; acheniis conformibus glabris oblongo-clavatis erostratis, areola terminali parva; pappo aut nullo aut sæpius e paleis 1–5 brevissimis lato-deltoideis in aristam tenuem nudam iisdem multoties longiorem productis decidius. (Tab. XVII.) Napa Valley, California, in plains and grassy places; May. (On the Sacramento river, *Rev. Mr. Fitch.*) Plant about a span high, slender, glabrous. Head nodding before anthesis. Involucre 3 lines long, of 7 to 10 equal scales, and of 5 or 6 minute calyculate scales. Corolla yellow. Achenia nearly 2 lines long, narrowed at the base, not at all contracted towards the summit, strongly 10-ribbed, the ribs upwardly scabrous, the apex obtuse, but not truncate, the terminal areola being much smaller than the diameter of the achenium. Some of the achenia are destitute of pappus, at least in many specimens; others in the same head bear from one to four, or sometimes five, capillary, barely scabrous arwns, which are abruptly dilated at the base into a very short and broad palea, just as in Scorzonella laciniata. So that this connects Scorzonella, and the following connects Ptilophora, with Calais.

Calais (Anacalais) sylvatica. Scorzonella sylvatica, *Benth. Pl. Hartw. No.* 1815, *p.* 320. Sonora, California; on hills; May. The slender but sometimes fusiform-thickened root is that of a biennial. Pappus sordid, of 6 to 9, or more commonly 10 paleæ; the long arwns strongly barbellate, almost plumose. The leaves in these specimens are scarcely, if at all, pinnatifid. On Mark West's creek, April 30, in low wet places, was gathered a specimen of what may (on account of an intermediate form gathered by Dr. Stillman) be received as a variety of this species, with the involucral scales all lanceolate and taper-pointed, and the arwns of the pappus less strongly barbellate.

Rafinesquia Neo-Mexicana, *Gray, Pl. Wright.* 2, *p.* 103. Gravelly hills of the Rio Colorado; February. In the single specimen the rays of the pappus are only 8, or even sometimes fewer.

Stephanomeria minor, *Nutt. in Trans. Amer. Phil. Soc. n. ser.* 7, *p.* 427. Plains, between the Canadian and the Rio Grande, New Mexico; September, This and S. runcinata are doubtless the same.

Lygodesmia juncea, *Don; Hook. Fl. Bor.-Am.* 1, *p.* 295, *t.* 103. Buffalo plains, Upper Canadian; September.

Pyrrhopappus Carolinianus, *DC. Prodr.* 7, *p.* 144. Beavertown, Arkansas; and on the grassy bottoms of the Rio Grande, New Mexico.

Macrorhynchus retrorsus, *Benth. Pl. Hartw. No.* 1817, *p.* 320. Hill-sides, Sonora, California; May. Plant stouter than Hartweg's specimens, and the fully developed head larger, but otherwise the same. Stems a foot high. Head from an inch to an inch and a half, or in fruit two inches long, cylindraceous, or at length cylindrical; the scales of the involucre all acute, somewhat tinged with purple; the exterior short, lanceolate or ovate-lanceolate, obscurely foliaceous above. Achenia all alike, oblong, smooth, and glabrous, wingless, acutely ribbed

and angled, somewhat muricate-toothed in a ring at the abrupt origin of the very long and capillary beak, which is more than thrice the length of the achenium. The latter is only 2½ lines long, while the beak is three-fourths of an inch long; the pappus fully half an inch long. The lobes of the leaves are all retrorse and callous-tipped, as described by Mr. Bentham.

Macrorhynchus grandiflorus, *Torr. & Gray, Fl.* 2, *p.* 492, (Stylopappus grandiflorus, *Nutt.*): var. involucri squamis exterioribus aut ovatis appendice acuminatis aut oblongo-lanceolatis. Hill-sides, Napa Valley, near Sonoma; May. Head in fruit an inch and a half long, broader and proportionally shorter than in M. retrorsus, the external calyculate scales more foliaceous and spreading. Achenia smooth and glabrous, oblong, acutely ribbed and angled, barely 2½ lines long, abruptly tapering into a filiform beak of three-fourths of an inch in length; the pappus only 4½ lines long. This may be a larger state of M. laciniatus, (of which I have only a miserable flowering specimen,) but it plainly passes into M. grandiflorus. The achenia differ from those of M. retrorsus, and the lobes or laciniæ of the leaves are either spreading or ascending.

Macrorhynchus humilis, *Benth. Pl. Hartw. No.* 1816, *p.* 320. Hills, near Punta de los Reyes, California; April. The leaves are larger and more glabrate than in my specimen of Hartweg's plant; the scape 6 to 10 inches high. The fusiform achenia are from 1½ to 2 lines long; the external rather longer than the inner ones; the latter more strongly and sharply ribbed, as Mr. Bentham remarks. The beak, though apparently full grown, is not longer than the achenium. If it varies so as to be "more than twice the length of the achenium," as Bentham characterizes the species, then it must pass, I should think, into M. Lessingii, *Hook. & Arn.;* of which we have no fruiting or certain materials; but it is said to have the beak "nearly thrice the length of the achenium."

Macrorhynchus heterophyllus, *Nutt. in Trans. Amer. Phil. Soc. l. c.; Torr. & Gray, Fl.* 2, *p.* 493. M. Chilensis, *Hook. in Lond. Jour. Bot.* 6, *p.* 256. Fields, Benicia and San Geronimo Ranch, California; April. This abounds in California and Oregon, where it is the only annual species known. Hooker pronounces this to the M. Chilensis; and it doubtless must be so considered, if that is held to include all the Chilian species. But the short wing-ribbed achenium (1½ to 2 lines long) and long beak (of 3 to 4½ lines) distinguish it from M. lævigatus, and less decidedly from M. pterocarpus, to one or the other of which Lessing's M. Chilensis is referred, though in neither are the achenia "plano-obcompressed." The ribs or wings of M. heterophyllus vary considerably in strength; they are scarcely, if at all, serruelate. When less salient and acute, they remain straight and even; when more developed, especially in the exterior achenia, these wings become strongly undulate at or before maturity, sometimes very strikingly so, giving the body of the achenium a remarkable corrugated appearance. Some different state of the marginal achenia has probably served as the basis of Nuttall's Cryptopleura Californica; but I have seen nothing that accords with his character of it.

Troximon parviflorum, *Nutt. in Trans Amer. Phil. Soc. l. c., p.* 434. Macrorhynchus cynthioides, *Hook. Pl. Geyer, in Lond. Jour. Bot.* 4, *p.* 256, ex char. Sandia mountains, New Mexico; October. The specimens, with mature fruit, are taller than Nuttall's; the scapes 9 inches high; the scales of the involucre tinged with purple, and the ligules of a remaining flower appear to have been purple. I suspect that T. roseum, *Nutt.*, is only a variety of this with pinnatifid leaves and purplish or rose-colored flowers. I should confidently refer the present specimens to Macrorhynchus purpureus, *Gray, Pl. Fendl.*, were it not for the short and stouter beak, of less than half the length of the body of the achenium; and the pappus is, perhaps, a little stiffer. Whether the difference holds constant or not, it is evident that the present plant effects a real transition between Troximon and Macrorynchus.

Mulgedium pulchellum, *Nutt. l. c.* Banks of the Pecos, New Mexico; October.

Sonchus oleraceus, *Linn.* Near San Gabriel, California; March.

LOBELIACEÆ.

Downingia pulchella. Clintonia pulchella, *Lindl. Bot. Reg. t.* 1909; *Hook. & Arn. Bot. Beechey, p.* 362. C. corymbosa, *DC. Prodr.* 7, *p.* 347. Borders of pools, on the Stanislaus River; May 8: and Santa Rosa creek; May 1. As the Clintonia of Rafinesque was published some years earlier than Douglas', we propose to dedicate this beautiful genus of annuals, now so frequent an ornament of our gardens, to the memory of the late A. J. Downing, Esq., whose name, in every part of the world, is associated with horticulture.*

CAMPANULACEÆ.

Heterocodon rariflorum, *Nutt. in Trans. Amer. Phil. Soc.* (*n. ser.*) 8, *p.* 255. Grassy plains, Napa Valley, California; May 5. Dr. Parry and Rev. Mr. Fitch also found this plant in California. It is a neat and very delicate annual, with flowers only 2 or 3 lines in diameter.

Dismicodon Californicum, *Nutt. l. c.* Plains and mountains near Marysville, California; May 25. Very near D. ovatum, and perhaps not distinct from that species. The uppermost flowers are nearly as large as in D. perfoliatum, and blue.

Githopsis specularioides, *Nutt. l. c.* Hill-sides and plains along the Stanislaus and Sacramento, also at Martinez; April—May. Most of the specimens belong to the vari. hirsuta, of Nuttall l. c.

ERICACEÆ.

Vaccinium ovatum, *Pursh; Dunal, in DC. Prodromus* 7, *p.* 570. Mountains near Oakland; April 4.

Arbutus Menziesii, *Pursh Fl.* 1, *p.* 282; *DC. l. c., p.* 582. Mountains near Oakland, and in other parts of California A tree 40 feet high.

Arctostaphylos tomentosa, *Dougl.; DC. Prodr.* 7, *p.* 585. Xerobotrys tomentosus, cordifolius, etc., *Nutt. in Trans. Amer. Phil. Soc.* Los Angeles; March 22. A shrub 4 or 5 feet high.

Arctostaphylos glauca, *Lindl. Bot. Reg. sub t.* 1791? Xerobotrys glaucus, *Nutt. l. c.* Hills near Downieville; May 21.

Arctostaphylos pungens, *H. B. K. Nov. Gen. & Sp.* 3, *p.* 278; *Hook. Bot. Mag. t.* 3027. A. Hookeri, *Don.* Andromeda? venulosa, *DC.* Xerobotrys venulosus, etc., *Nutt.* Daphnidostylis pungens Hookeri, *Klotzsch, in Linnæa* 24, *p.* 81. Hills near Downieville, and San Francisco; May 22: in flower. Napa Valley; April 25: with old fruit.*

Azalea occidentalis, *Torr. & Gray, Fl. ined.* A. calendulacea, *Benth. Pl. Hartw. p.* 321. Rhododendron calendulaceum, *Hook. & Arn. Bot. Beech. p.* 362. Laguna de Santa Rosa, in low and wet ravines; May 1. Differs from A. calendulacea, among other characters, in its *white* flowers.

Pyrola chlorantha, *Nutt. Gen.* 1, *p.* 273; *Hook. Fl. Bor.-Amer.* 2, *p.* 46. Hills near Downieville, Yuba river; May 22.

Chimaphila Menziesii, *Hook. Fl. Bor.-Amer. p.* 49, *t.* 138. C. dasystemon, *Haw. Supp.* Hill-sides near Downieville, (with unexpanded flower buds.)

Pterospora Andromedea, *Nutt. Gen.* 1, *p.* 269; *Torr. Fl. N. York* 1, *p.* 458. Hill-sides, Duffield's Ranch, Sierra Nevada; May 11, (in fruit.) The only specimen collected is more than two feet high.

*Kunth (Enum. 5, p. 156, adnot.) proposed to change the later name of Lindley to Wittia, in honor of the same distinguished statesman and patron of science (De Witt Clinton) to whom the earlier genus was dedicated. But it would be inadmissible to bestow two genera on the same person.

* "The genera recently severed from Arctostaphylos are not well founded. Different fruits of A. Uva-Ursi, both American and European specimens, exhibit the characters of Daphnidostylis, *Klotzsch*, Xerobotrys, *Nutt.*, and even of Comarosathtphylis, *Zucc.* Indeed, one of Klotzsch's new species of Daphnidostylis (D. Fendleri) is only Arctostaphylo Uva Ursi" *Gray, Mss.*

Sarcodes sanguinea, *Torr. in Smithson. Contrib.* 6, *p.* 19, *t.* 10. Hill-sides, Duffield's Ranch, Sierra Nevada; May 12. Fine specimens, in full flower, of this rare plant were collected by Dr. Bigelow. They differ from Fremont's only in the scales being more strongly ciliate.

PLANTAGINACEÆ. (By A. Gray.)

Plantago maritima, *Linn.* Corte Madera, California, within reach of the tide; April. The sepals, especially the posterior ones, are strongly crested, more so perhaps than in the plant of the Atlantic States, which seems to pass by gradations into the northern crestless form, (P. juncoides, *Lam.*, P. pauciflora, *Pursh,* and P. decipiens, *Barnéoud.*)

Plantago Patagonica, *Jacq.* var. gnaphalioides. P. gnaphalioides, *Nutt. Gen.* 1, *p.* 100. Williams' Fork of the Great Colorado; February: a depauperate form. Cocomungo; March: a still more diminutive and glabrate form. A widely diffused species, extending nearly the whole length of the continent on the western side, and with us exhibiting some remarkable varieties; for to this species we must refer not only the Chilian P. Patagonica, (P. mollis, *Hook. & Arn.*,) but P. Hookeriana, *Fisch, & Meyer*, P. gnaphalioides, *Nutt.*, P. spinulosa, *Decaisne*, P. curta, *Engelm.*, P. Wrightiana, *Decaisne*, P. Xorullensis, *H.B.K.?*, P. aristata, *Michx.*, P. squarrosa, *Nutt.*, and P. filiformis, *Decaisne*. This species is *diœcio-dimorphous*, some individuals having small anthers on short filaments, and mostly included in the throat of the corolla, while others bear large anthers on long exserted filaments as in the genus generally. Both sorts perfect fruit, but the former (as is usual in such cases) is the most fruitful.

Plantago Bigelovii (sp. nov.): pusilla, parce minutim hirsuta vel glabrata, annua; foliis carnulosis lineari-filiformibus obtusis integerrimis; spica brevi-oblongo 3–12-flora densa; staminibus 2; capsula oblongo-ovoidea 3–4-sperma bractea ovata acuta calyceque longiore. Benicia, California; April 23. Leaves 1–2 inches long, half a line wide. Scape 2–3 inches high. Bracts carinate, the margins broadly scarious. Sepals broadly oval, very obtuse, scarious, with a green and thickened centre. Flowers twice as large as those of P. pusilla, in the specimens all perfect and fertile; the two stamens more or less exserted, but not so long as the style. Lobes of the corolla ovate, open or spreading in fruit. Capsule a line and a half long at maturity, when it becomes one-third longer than the calyx. Ovules 2 in each cell. Seeds oblong, nearly as in P. pusilla. By the latter we mean, of course, Nuttall's P. pusilla, not what Decaisne has taken for it, and characterized in DeCandolle's Prodromus. His plant, as also his P. perpusilla, is P. heterophylla, *Nutt. in Trans. Amer. Phil. Soc. n. ser.* 5, *p.* 177, which, although often larger and with sparingly-toothed or incised leaves, is to be distinguished with certainty only by its 10–28-seeded capsule, more oblong or conoidal in form, and exserted to twice the length of the calyx when mature. P. pusilla has only a pair of ovules and seeds in each cell. These three species accord in being *diandrous*, (a fact first noted for P. pusilla by Dr. Torrey in his Flora of New York, where, however, the capsule is inadvertently said to be *two-seeded*, instead of four-seeded;) but P. tenuiflora, *Kit.*, is not so: they are also *subdiœcious* or *diœcio-dimorphous*, more decidedly so than P. Patagonica, and with the corolla inclined to be closed in the more fertile form, but less so than in P. Virginica* and its allies.

* It is remarkable that the diœcio-dimorphous character of the wide-spread and variable P. Virginica (which includes P. occidentalis, rhodosperma, echioides, Cumingiana? and purpurascens, (*Nutt.*, of Decaisne) and some allied species, has not long before this been distinctly made out. Both *subsexes* have been described, indeed; some authors indicating the one, some the other, some mixing up the two incongruously in their descriptions; while others, as Nuttall and Decaisne, have mistaken them for separate species. The *substerile* plant, as we may call it, since it rarely ripens any seeds, exhibits the usual exserted stamens and large anthers of the genus, and its corollas remain open after anthesis; this is Nuttall's P. purpurascens, of which, with other substerile forms of the same and some allied species, Decaisne has made his section *Novorbis*. That these are mostly sterile plants may be inferred from the circumstance that of the fifteen admitted species of the section, only two have the capsule and seed described, although specimens of all of them have been examined by Decaisne himself; yet in such a spicate inflorescence it rarely happens that a dried specimen of a truly fertile plant fails to offer some full-grown fruit and seed. The truly fertile form, which is the most common in herbaria, bears flowers all of which are provided with short or included filaments and

They compose a small section section of the genus, quite otherwise characterized, however, than is Decaisne's Micropsyllium, and not embracing all his species.

PLUMBAGINACEÆ.

Armeria vulgaris, *Willd.*, var. A. Andina var. Californica, *Boiss. in DC. Prodr.* 12, *p.* 682; *Benth. Pl. Hartw. p.* 332. Hills near San Francisco; and Laguna of Santa Rosa creek; April. We are not satisfied with the characters on which the acute Boissier has separated into many species what may, perhaps, better be regarded as variations of A. vulgaris.

STYRACACEÆ.

Styrax Californicum, *Torr. Desc. Darlingt. in Smithson. Contrib.* 6, *p.* 4, *t.* 12. Hill-sides and river banks, Mokelumne Hill, California; May 17: in blossom. Some of the racemes are 5–6-flowered. This is quite an ornamental shrub, and well deserves cultivation.

PRIMULACEÆ.

Trientalis Europæa, *Linn.* var. latifolia. T. latifolia, *Hook. Fl. Bor.–Am.* 2, *p.* 121. Tokcloma creek; April 16. Mountains, near Oakland, California; April 5.

Glaux maritima, *Linn.* Martinez, California; April 23.

Anagallis arvensis, *Linn.* There was no label to this plant. It is, however, common in California, and was doubtless introduced from Europe.

Dodecatheon Meadia, *Linn.* var. D. integrifolium and D. frigidum, (*Cham.*) *Hook. Fl. Bor.–Am.* 2, *p.* 118. Cocomungo; March 17; and mountains, near Oakland, California; April 4. We can recognize but one species of Dodecatheon. The length of the tube of filaments is exceedingly variable.

OROBANCHACEÆ. (By A. Gray.)

Boschniakia strobilacea (sp. nov.): squamis orbicularibus vel obovato-rotundis obtusissimis ubique confertim imbricatis, floralibus flores subæquantibus; calyce postice truncato haud obliquo, dentibus 3 lineari-subulatis tubo longioribus; labio corollæ inferiore patente superius adæquante, lobis oblongis; filamentis basi barbatis; placentis 4 æquidistantibus. Dry and rocky hills, South Yuba, California; May. A span high, thick, resembling Conopholis Americana in aspect, the scales larger and broader, about half an inch wide, brown in the dried state. The three slender teeth of the calyx are anterior and lateral, a line and a half long; the two others obsolete or indistinct. Anthers sparsely hairy. The shape of the scales and of the calyx teeth at once distinguishes this from B. tuberosa and B. glabra of Oregon, etc.

Phelipæa Californica, *Don, Syst.* 4, *p.* 632. Orobanche Californica, *Cham. & Schlecht. in Linnæa*, 3, *p.* 134. Plains, near Marysville, California; May. The specimen renders it probable that P. Californica is not distinct from P. Ludoviciana, which has a wide range. It is nearly allied on the other hand to P. comosa, (the Orobanche comosa of Hooker,) which must find a place in this genus, notwithstanding the bractlets are remote from the calyx.

Aphyllon uniflorum, *Gray, Man. Bot. N. States, ed.* 1, *p.* 290. Napa valley, California; April 27. The range of this species includes all temperate North America, from Newfoundland and Canada, south to Florida and Texas, and west to the Pacific. Had Wallroth's name of Anoplon been generally adopted by succeeding botanists, it might have been unwise to disturb it. But

very small anthers—whether sterile or precocious is uncertain, probably the latter, as the ovary is uniformly fruitful;—and the corolla, as is well known, becomes connivent-closed after anthesis, its broad lobes involutely and imbricately enwrapping each other, so as to form a kind of beak surmounting the fruit. This is the type of Decaisne's section *Cleiosantha.*—*Gray, Mss.*

since Endlicher's name of Anoplanthus has been adopted by Reuter, the monographer of the order in De Candolle's Prodromus, while Nuttall has preferred the prior claim of his unobjectionable name Gymnocaulis, there can be no question of the propriety of restoring the far older name of Aphyllon, under which Mitchell characterized the genus more than a hundred years ago. There is considerable reason for thinking, however, that the genus will be reduced to a mere section of Phelipæa.

SCROPHULARIACEÆ. (By A. Gray.)

Linaria Canadensis, *Dum.* Near San Francisco, and elsewhere in California; April. A species diffused over all the temperate parts of the American continent.

Scrophularia nodosa, *Linn.; Benth. in DC. Prodr.* 10, *p.* 309. Corte Madera and Napa Valley; April. A species common to the temperate portion of the whole northern hemisphere.

Collinsia bartsiæfolia, *Benth. in DC. Prodr.* 10, *p.* 318. Bolinas bay and Punta de los Reyes, California; April.

Collinsia tinctoria, *Hartw.; Benth. Pl. Hartw. p.* 328. Wet ravines, Knight's Ferry, etc., California; May. This and the foregoing are likely to pass into the next.

Collinsia bicolor, *Benth. in Hort. Trans.* 1, *p.* 480. Hill-sides, Martinez, Mokelumne, etc., California; May.

Collinsia parviflora, *Dougl. in Bot. Reg. t.* 1082. Hill-sides, on the Yuba; May. Var. sparsiflora, *Benth.* (C. sparsiflora, *Fisch & Meyer.*) Corte Madera, Napa Valley, and mountains, near Oakland, California; April. The corolla is not only larger, but longer in proportion to the calyx; still intermediate forms appear to connect it with C. parviflora, as Bentham states.

Pentstemon centranthifolius, *Benth. Scroph. Ind. p.* 7, *& in DC. Prodr.* 10, *p* 323. Plains, near San Gabriel, California; March.

Pentstemon microphyllus (sp. nov.): fruticosus, ramosissimus, foliis in axillis crebre fasciculatis (minutis) obovatis ovatisve obtusissimis coriaceis integerrimis subpetiolatis; racemis paniculatis; sepalis fructiferis oblongo-ovatis. On Williams' Fork of the Colorado, New Mexico. The specimens were collected in February, and are without flowers, but they bear the remains of the fruit of the preceding season. The plant is a remarkable one, and may possibly not belong to this genus. The leaves are only one or two lines long, of a thick and firm texture, and arise three or seven together from short spurs or undeveloped branches. The peduncles are opposite and alternate, somewhat spreading, and about as long as the fructiferous calyx. There is nothing peculiar about the capsule; and the aspect of the plant is that of the section Erianthera.

Pentstemon Lewisii, *Benth. l. c.?* Rocky ravines, Cajon Pass, California; March 16. The specimen belongs to a shrubb species, and bears only the vestiges of the last year's fruit. The leaves are not so finely and evenly denticulate as those of P. Lewisii; but for the present it may be referred to that species.

Pentstemon breviflorus, *Lind. Bot. Reg. t.* 1946. Knight's Ferry, on the Stanislaus; May. A shrubby species, as already noted by Hartweg.

Pentstemon heterophyllus, *Lindl. Bot. Reg. t.* 1899. Butte mountains, near Marysville, California; May. The variety with narrower sepals, without manifest scarious margins, (*Hook. & Arn. Bot. Beech.;*) the same as Hartweg's No. 1880, and not to be well separated from P. azureus, *Benth. Pl. Hartw.* No. 1819, which seems, as to the calyx, to connect all the forms.

Pentstemon spectabilis (*Thurber in A. B. Gray's Rep. ined.*): undique glaber; caule stricto elato (3–4-pedali) herbaceo; foliis coriaceis serraturis rigidis crebris argute dentatis oblongis seu ovato-lanceolatis sæpius acutis, imis sessilibus, reliquiis connato-amplexicaulibus, superioribus floralibusque orbiculato-disciformibus; panicula ampla elongata virgato-pyramidali; pedunculis 3–9-floris; sepalis orbiculari-ovatis carnosis; corolla e tubo brevi (calyce duplo

longiori) angusto subito ventricosa campanulata modice bilabiata, lobis 5 consimilibus rotundatis patentibus; filamento sterili filiformi glabro; antheris (Cepocosmi) glabris. San Francisco Mountain, New Mexico, December 16. Imperfect specimens, with fruit only. But they clearly belong to a species which we first received from Mr. William A. Wallace, from Cocomungo and Los Angeles, California; and soon after from Mr. George Thurber, who gathered it in the same district. Mr. A. B. Gray likewise gathered fragments of the same on the Gila river. It must be one of the showiest species known, and it will appropriately bear the name imposed upon it by Mr. Thurber. The crowded pianicle of purplish blue flowers is often two feet in length, and free from leaves, the lowest bracts not exceeding the peduncles, while the upper are reduced to small and inconspicuous perfoliate disks. Peduncles and spreading pedicels each half an inch to an inch long. Sepals 3 lines long, obtuse or apiculate. Corolla an inch or more in length; the proper tube about twice the length of the calyx, then abruptly expanded into a campanulate throat, glabrous inside; the two lips of equal length, and the lobes very similar. Leaves apparently somewhat glaucous, 3 or 4 inches long; only the radical petioled; all the upper cauline connate into a disk, which is an inch or two in width where it is perforated by the stem.

Diplacus glutinosus, *Nutt.* Hill-sides, Sonoma, Punta de los Reyes, etc., California; May. The species also includes D. leptanthus and D. longiflorus of Nuttall.

Mimulus brevipes, *Benth. Scroph. Ind. p.* 28, *& in DC. l. c.* Hill-sides, on the Stanislaus; May.

Mimulus luteus, *Linn.; Benth. in DC. l. c.* Various forms of this polymorphous plant: Napa Valley, etc., California, and Williams' River; February—May.

Mimulus dentatus, *Nutt. in Herb. Hook.; Benth. l. c.* Hill-sides, at Murphy's, California. Also (a narrow-leaved variety) near Mammoth Grove; May.

Mimulus moschatus, *Dougl. in Bot. Reg. t.* 1118. Wet ravines on the Yuba, near Downieville, California; May.

Mimulus bicolor, *Benth. Pl. Hartw. p.* 328, *No.* 1892. Hill-sides, near Sonora, California; May. A depauperate form.

Mimulus floribundus, *Dougl. in Bot. Reg. t.* 1125. Grass valley, California, in low places; May. A small form.

Mimulus inconspicuus (sp. nov.): annuus, glaber; caule gracili 1–2-pollicari adscendente paucifoliato; foliis ovalibus seu ovatis subintegerrimis obsolete 3–5-nerviis subsessilibus; pedunculis solitariis foliis et flore parvo brevioribus; calyce prismatico, dentibus brevissimis subæqualibus; tubo corollæ paullo exserto. Damp hill-sides, Los Angeles, California, May. Leaves 5 or 6 lines long, the cauline only a single pair in the specimens. Peduncle 2 or 3 lines long. Flower 4–5 lines long; the corolla yellow tinged with rose-color in the dried plant, its lobes very small. Fructiferous calyx not seen.

Eunanus Douglasii, *Benth. in DC. Prodr.* 10, *p.* 374. Gravelly hills, Sonora, and Mokelumne Hill, California; May. The former specimens, like those of Douglas, etc., are very dwarf and simple; the stem, of only 2 or 3 internodes above the cotyledons, barely half an inch long, while the flower it is terminated with is fully an inch long. Those from the latter locality, like Hartweg's No. 1894, are developed into many-flowered branches 4 inches high, the lower part fructiferous. To Bentham's description of the capsule, from Hartweg's specimens, we have only to add that it is often nearly linear, 4 or 5 lines long, not much compressed, of a crustaceous texture, but at length dehiscent; the valves bearing the many-seeded placentæ. The ovoid seeds are apiculate at each end. The calyx, as in the next species, is very oblique at the orifice; in this it is narrow and prismatic, and its teeth are very short and obtuse. The marked difference between this species and E. Frémonti, and perhaps E. Tolmæi, (which we have not seen,) led us to propose its generic separation, as Mr. Bentham has stated; but his judgment in the combination is fully sustained by the characters of the following intermediate species.

Eunanus Coulteri, (*Benth. Pl. Hartw. p.* 320): foliis inferioribus ovatis oblongisve, superioribus spathulato-lanceolatis pollicaribus; calycis infundibuliformis dentibus lanceolatis,

supremo tubo vix dimidio breviore; corollae tubo calycem bis terve superante, fauce valde ampliata, labiis subæquilongis; stigma obtuse bilabiato, labiis brevibus latis inæqualibus sed consimilibus; fructu immaturo subgloboso. Low places, Mark West's creek; April, and Knight's ferry, on the Stanislaus; May. (Also communicated by Dr. Andrews, etc.) Flower fully as large as that of E. Douglasii, often an inch and a half or even two inches long, lilac? the throat mottled with deep purple. Immature seeds apiculate at both ends. This is not the E. Coulteri, *Harv. & Gray*, in the herbarium of Trinity College, Dublin, (Coll. Coult., No. 614;) but as no character of that has been published, and as recent specimens lead us to think it not different from E. Fremonti, the name should be retained for the present species, to which Bentham applied it, although we are not sure that it occurs in Coulter's collection.

Eunanus Bigelovii (sp. nov.): foliis caulinis oblongo-lanceolatis acutis; calycis subcampanulatis valde plicato-angulatis, ore vix obliquo, dentibus inæqualibus triangulari-subulatis pungentibus dimidium tubi longitudine paullo excedentibus; corollæ tubo calyce subduplo longiore, limbo patentissimo, lobis æquilongis; stigmate integro. Gravelly hills, near the Colorado of California; February 17. On the Mohave creek; March 2. Plant only beginning to blossom, 1–2 inches high, doubtless attaining a greater height as the season advances. Largest leaves an inch long, more or less viscid-pubescent, like the stem. Calyx 4–5 lines long. Corolla 6–8 lines long, of the same shape as in E. Fremonti; the foliage and the calyx quite different.

Veronica Americana, *Schwein.; Benth. in DC. Prodr.* Santa Rosa creek, California; May.

Castilleia affinis, *Hook. & Arn. Bot. Beech.*, *p.* 154. Cocomungo, California; March. The same as Hartweg's No. 1896.

Castilleia hispida, *Benth. in Hook. Fl. Bor.-Am.* 2, *p.* 105. San Francisco and Punta de los Reys; April.

Orthocarpus pusillus, *Benth. Scroph. Ind., in DC. Prodr.* 10, *p.* 535. Low grounds, San Francisco; April.

Orthocarpus floribundus, *Benth. l. c.* San Francisco, California; April.

Orthocarpus erianthus, *Benth. l. c.* Benicia, California; April.

Orthocarpus lithospermoides, *Benth. l. c.* Mark West's creek, California; April.

Orthocarpus (Triphysaria) faucibarbatus (sp. nov.): foliis linearibus 1–3-nerviis ultra medium pinnatifidis cum caule erecto ramoso lævi glabris, laciniis angusto-linearibus fere filiformibus elongatis; bracteis viridibus scabro-puberulis floribus brevioribus; spicis demum interruptis; calyce tubo corollæ pubescente dimidio breviore, dentibus triangulari-lanceolatis obtusis vix dimidium tubi adæquantibus; corollæ labio inferiore trisaccato, fauce secus plicas 2 palatinas longe barbata, appendiculis brevissimis obtusis; antheris unilocularibus. Corte Madera, California; April 20. Plant rather stout, 9 or 10 inches high, with spreading branches. Cauline leaves 2 inches long; the bracts becoming shorter and broader, the upper ones nearly palmate. Flowers 7–8 lines long. Calyx minutely pubeseent. Corolla apparently pale yellow. Allied to O. lacerus and O. lithospermoides of Bentham. The last named has the throat of its corolla somewhat villous-pubescent; that of the others is glabrous. Besides the smoothness and the one-celled anthers, the calyx distinguishes the present species.

Orthocarpus densiflorus, *Benth. l. c.* Corte Madera and San Gabriel; March and April.

Orthocarpus castilleioides, *Benth. l. c.?* Corte Madera, California; April. Too young for proper determination.

Orthocarpus (Oncorrhynchus) attenuatus (sp. nov.): cinereo-pubescente; caule gracili stricto; foliis anguste linearibus sursum filiformi-attenuatis integerrimis vel summis cum bracteis viridibus trifidis, lobis attenuatis; spica angusta; calyce corolla tertia parte breviore postice fisso, dentibus linearibus obtusis tubo dimidio brevioribus; corollæ labio inferiore vix trisaccato, appendiculis oblongis obtusis ventriculo brevioribus galeam rectam truncatam subæquantibus; antheris bilocularibus. Corte Madera; April 16. A span high. Corolla narrow, 7 lines long, puberulent, white or cream-color, with the slightly ventricose lower lip spotted with purple.

Pedicularis densiflora, *Benth. in Hook. Fl. Bor. Amer.* 2, *p.* 110, *in DC. l. c.*, *p.* 574. Napa Valley, California; April 5. In fruit.

Pedicularis attenuata, *Benth. in DC. l. c.* Mountains near Oakland, California; April 5. In flower.

BIGNONIACEÆ—SESAMEÆ. (By A. Gray.)

MOHAVEA, Nov. Gen.

Calyx alte 5-partitus, laciniis lanceolatis foliaceis fere æqualibus. Corolla hypogyna, profunde bilabiata personata, limbo amplo patenti tubo campanulato multo longiore; labio postico latissimo rotundo emarginato-bilobo, æstivatione exteriore, basi fornice supra antheras arcuata instructo; labio antico consimili subtrilobo, palato prominente medio barbato. Stamina fertilia 2, tubo corollæ inserta: filamenta apice incurva: antheræ approximata rotundo-reniformes, confluentim uniloculares. Filamenta sterilia sæpius 2, exigua. Stylus columnaris: stigma compresso-capitatum, integrum. Ovarium ovoideum, biloculare, placentis axilibus, apice tantum placentis haud coalitis uniloculare, parietibus membranaceis. Ovula multa, pluriseriata, horizontalia vel adscendens, anatropa. Fructus ignotus. Herba humilis, ramosa, diffusa, pilis viscidis et glanduliferis pubescens; radice annua; foliis alternis, imisve oppositis, oblongo seu ovato-lanceolatis, integerrimis vel repando-angulatis, penninerviis, basi angustata parallelinerviis; floribus axillaribus solitariis, pedunculis nudis brevibus; corolla ochroleuca? et purpurascente, fauce cum palato purpureo picta.

Mohavea viscida. Mohave Creek, California; March 2. Leaves $1\frac{1}{2}$ to 2 inches long. Sepals half an inch long, exceeding the short tube of the corolla. Lips of the corolla nearly an inch broad, apparently flat. Filaments and style somewhat hairy towards the base, included within the throat. Ovary 2-celled, except near the summit, with no dorsal introflexion of the walls, the placentæ not bilammelar. Style nearly as long as the stamens. Notwithstanding the ovary, which is strictly 2-celled, except at the top, we suspect this curious plant to belong to the Bignoniaceæ–Sesameæ; but the fruit alone can determine the question. If the seeds prove to be albuminous, we know not where in the order Scrophulariaceæ to place it. In one of our few specimens a singular abnormal body was found growing from the outside of the corolla at its base, resembling a long-clawed petal, with a small, truncate, saccate, and involute limb. It is evidently a monstrosity.

VERBENACEÆ.

Verbena prostrata, *R. Br. in Hort. Kew.* (*ed.* 2) 4, *p.* 41; *Schauer in DC. Prodr.* 11, *p.* 547. Banks of the Mokelumne River, California, May 17.

LABIATÆ.

Pycnanthemum Californicum (*Torr. in Durand, Pl. Pratt. in Jour. Acad. Phil.* 2, *p.* 99): incano-pubescens, foliis ovato-lanceolatis sessilibus parce denticulatis; verticillastris 2–4 densissimis, demum scorpoideo-explanatis multiradiatis; calycis dentibus æqualibus lanceolatis muticis. California, probably from the lower part of the Sacramento Valley. Gathered by Colonel Frémont, (1846), Rev. A. Fitch, & Mr. Shelton.

P. Californicum, var. foliis tenuioribus oblongis glabriusculis viridibus. River banks and ravines, Mokelumne, California, (with the persistent inflorescence of the preceding year).—This plant is a genuine Pycnanthemum, and is most nearly related to P. muticum. No other species is found west of the Rocky Mountains. The inflorescence is at first in the form of compact heads, of which there are usually three on the main axis. Late in the season these unfold into very dense sessile cymes, the branches of which are secund, and nearly an inch in length.

The variety found by Dr. Bigelow was not in flower. It seems to be a tall plant. The leaves are 3–4 inches long and nearly an inch broad.

MONARDELLA CANDICANS, *Benth. Pl. Hartw. p.* 330, (*No.* 1911); *Durand, l. c.* Sides of rivulets, Knight's Ferry, Stanislaus, May 7. The lobes of the corolla in this and some other species have a small hemispherical sac at the tip. The stamens are strongly didynamous. This species is found as far south as San Diego, and north to the Upper Sacramento.

M. CANDICANS, *β.* VENOSA: foliis angustioribus; bracteis mucronatis capitulis longioribus, inter venas validas hyalino-membranaceis. Plains of Feather River, near Marysville, May 25. Also collected in California by Rev. A. Fitch. The bracts of this plant are very remarkable. They are larger than in the ordinary form of M. candicans, and between the strong veins (which are usually of a purplish color) there is no parenchyma, but only the thin transparent epidermis resembling goldbeater's skin. The corolla is much exserted, of a deep rose color, and has the lobes tipped with a little sac, as in the common variety.

POGOGYNE DOUGLASII, *Benth. Lab. p.* 414, *& in DC. Prodr.* 12, *p.* 243. Plains and low places, Stockton, May 7; valley of the Sacramento, May 26. All the species of this genus are annual.

HEDEOMA? SERPYLLOIDES (sp. nov.): annua, e basi ramosa prostrata; foliis obovatis obtusis integris, basi in petiolem attenuatis; verticillastris 2–6-floris sessilibus basi bibracteolatis, bracteolis oblanceolatis flore longioribus; calyce vix bilabiato, profunde quinquefido, segmentis angusto-lanceolatis patulis; corolla calyce paulo breviore, labio superiore plano ovato obtuso labio inferiore trifido, laciniis subæqualibus, intermedio subemarginato. Hill-sides, Martinez, California, April 23. A slender annual, with divaricate puberulent branches. Leaves 5–6 lines long (including the petiole), ciliolate at the base, otherwise nearly glabrous. Early flowers solitary, the later ones in 2–6-flowered cymules. Tube of the calyx very short; the 3 superior segments (upper lip) broader and longer than the others, all of them cuspidate. Stamens 2, the upper pair wanting.

SALVIA CARDUACEA, *Benth. Lab. p.* 302, *& in DC. Prod.* 12, *p.* 349. S. gossypina, *Benth. Pl. Hartw. p.* 330. Plains, Knight's Ferry, Stanislaus, May 7. We have no doubt of S. gossypina being a mere variety (as Mr. Bentham suspected) of S. carduacea.

SALVIA COLUMBARIÆ, *Benth. l. c.* Sides of rivulets, Knight's Ferry, California, May. This is an annual species, and varies greatly in size, as well as in the lobing of the leaves.

AUDIBERTIA HUMILIS, *Benth. Lab. p.* 313, *& in DC. Prodr.* 12, *p.* 359. Hill-sides, near Nevada City, May 20. Leaves most clustered towards the base of the stem; the proper cauline ones being seldom more than a single pair.

SCUTELLARIA TUBEROSA, *Benth. l. c.* Plains, near San Gabriel, March 23. Dr. Parry collected this species near Monterey. It was found also by Mr. Gibbes in Calaveras county; by Dr. Stillman on the Upper Sacramento; by Mr. Thurber and Rev. Mr. Fitch in the lower part of the Sacramento valley. It is variable in its pubescence, being sometimes almost glabrous. The calyx, however, is always villous. The leaves frequently oblong and narrowed at the base. Besides the principal tuber, from which the stem arries, there are often others at the extremity of the fibrous roots, or rather subterranean branches. They are about three-fourths of an inch in length, oblong, pubescent, tapering to the extremity, jointed, and of a fleshy consistence. Sometimes they show a tendency to ramify. They appear to be true tubers, like those of the potato.

SCUTELLARIA ANTIRRHINOIDES, *Benth. in Bot. Reg. fol.* 1493, *& in DC. Prodr.* 12 *p.* 428. Var. foliis dentatis, interdum sessilibus. River banks, Mokelumne Hill, May 17. We have the same variety, collected in California by Frémont (1846) and by Rev. A. Fitch. The leaves are larger than in the Oregon plant, and the upper ones are sometimes closely sessile.

MARRUBIUM VULGARE, *Linn.; Benth. in DC. Prodr.* 12, *p.* 453. River banks, Mokelumne Hill, California, May 17. Introduced from Europe.

STACHYS AJUGOIDES, *Benth. in Linnæa* 6, *p.* 80, *& in DC. Prodr.* 12, *p.* 468. Bolinas bay,

April 19. Bracts shorter than the calyx, ovate. Teeth of the calyx triangular-ovate, spinescent at the tip, somewhat recurved.

STACHYS CHAMISSONIS, *Benth. l. c.* Hill-sides, Napa Valley, California; April 26.

BORAGINACEÆ.

LITHOSPERMUM (BATSCHIA) CANESCENS, *Lehm. Asperif.* 2, *p.* 305? Hill-sides, Grass Valley, California; May 20. Except in being less canescent than the eastern plant, we can find nothing to distinguish this from some of our specimens of L. canescens.

AMSINCKIA SPECTABILIS, *Fisch. & Mey. Index Hort. Petrop.* 1835; *DC. Prodr.* 10, *p.* 118. Los Angeles, March 21. Gravelly hills of the Colorado, February 20. On Mohave creek, March 14. Near San Francisco, April 3. The place of insertion of the stamens is by no means a constant character in this genus. In the same species they sometimes are inserted in the throat, and sometimes towards the base of the corolla. A. intermedia seems to be no more than a variety of A. spectabilis.

ERITRICHIUM FULVUM, *Alph. DC. in Prodr.* 10, *p.* 132. Myosotis fulva, *Hook. & Arn. Bot. Beech. p.* 369. Cocomungo, California; March 17. The fruit is scarcely mature enough for comparison, but our plant is very like specimens of E. fulvum from Chili, and it is certainly Myosotis fulva of Hooker and Arnott.

ERITRICHIUM CALIFORNICUM, *DC. Prodr.* 10, *p.* 130. Myosotis Californica, *Fisch. & Mey. Ind. Sem. Hort. Petrop.* 1835, *p.* 42. Near San Francisco, April 8. E. Scouleri, *DC. l. c.* (Myosotis Scouleri, *Hook. & Arn.*) seems to be a mere variety of this species.

ERITRICHIUM CHORISIANUM, *DC. l. c.* Myosotis Chorisiana, *Cham. in Linnœa*, 1829, *p.* 444. With the preceding, from which it is chiefly distinguished by its much longer pedicels.

ERITRICHIUM PLEBEIUM, *Alph. DC. l. c.* Lithospermum plebeium, *Cham. & Schlecht. in Linnœa*, 1829, *p.* 446. With the preceding. The flowers are much larger than in E. Californicum.

PECTOCARYA LINEARIS, *DC. Prodr.* 10, *p.* 120. On gravelly hills, near the Colorado of California, February 17. This species differs from all the others of the genus in the nutlets being pectinate with acute teeth, instead of bristles.

PECTOCARYA CHILENSIS, *DC. Prodr.* 10, *p.* 120; var. CALIFORNICA: nuculis obovatis, planoconvexis calyce brevioribus. Hill-sides and wet places, near Los Angeles; May 14. Embryo straight, cotyledons nearly orbicular. We find the radicle inferior (not superior, as stated by Alph. De Candolle) in all the species of this genus that we have examined. P. pencillata was found in California by Frémont in his second expedition, and it is No. 516 of Coulter's Californian collection. In this species the nutlets are somewhat panduriform, and are chiefly pectinate on the upper half. The middle contracted portion is naked, and towards the base the hooked hairs are much smaller than those above.

KRINITZKIA LEIOCARPA, *Fisch. & Mey. Ind. Sem. Hort. Petrop.* 1841, *p.* 52. Myosotis flaccida, *Dougl. in Hook. Fl. Bor.-Amer.* 2, *p.* 82. Hill-sides, Knight's Ferry, Stanislaus river. There are specimens, in a young state, of what seems to be the same plant from gravelly hills along the Colorado of California. We find very often but a single nutlet matured in one flower. Mr. Bentham makes the same remark of Hartweg's specimens.

CYNOGLOSSUM GRANDE, *Dougl. Mss.; Lehm. Pug.* 2, *p.* 25; *Hook. Fl. Bor.-Amer.* 2, *p.* 85. Mountains, near Oakland, California; April 4.

HYDROPHYLLACEÆ.

ERIODYCTION TOMENTOSUM, *Benth. Bot. Sulph. p.* 35. E. crassifolium, *Benth. l. c.* Near San Gabriel, California; March.

ERIODYCTION GLUTINOSUM, *Benth. l. c.* Sonora, Cajon Pass, Mokelumne hill, etc., California; Also, var. ANGUSTIFOLIUM, (E. angustifolium, *Nutt. Plant. Gamb.*,) from hills near Cactus Pass, in the western part of New Mexico; January 30.

NAMA JAMAICENSIS, (*Linn.?*): hispido-hirsuta; caule decumbente; foliis lanceolato-spathulatis in petiolum decurrentibus; floribus subgeminis axillaribus pedicellatis; corolla campanulato-infundibuliformi calyce duplo-longiore; sepalis angusto-linearibus. Gravelly hills near the Great Colorado; February 17. Also found near Fort Yuma by Major G. H. Thomas and Lieutenant Du Barry. It is a common species in the valley of the Rio Grande. We refer it to N. Jamaicensis with much doubt.

ROMANZOFFIA SITCHENSIS, *Cham. in Linnæa.* 2, *p.* 609; *Bong. Veg. Sitch. t.* 4. Redwoods, California; April 12. It is interesting to meet with this species in California, where doubtless it is confined to the mountains. Dr. Bigelow's beautiful specimens accord very well with those we possess from Sitcha, from Mertens' collection. The calyx is glabrous. Choisy, (in *DC. Prodr.* 10, *p.* 135,) who had not seen the plant, has written "calycis *hirsuti*," doubtless by a slip of the pen, in place of *glaberrimi*, the word used by Chamisso.

HYDROPHYLLUM CAPITATUM, *Dougl. in Benth. Hydrophyll.; DC. Prodr.* 9, *p.* 289. Hill-sides, Duffield's Ranch, Sierra Nevada; May. The peduncles are longer than usual, and the leaves are as large as in H. macrophyllum; but the segments are sparingly incised, not coarsely toothed, and the lobes of the corolla have a pubescent line along the back. Perhaps the eastern and western plants may be united.

NEMOPHILA PARVIFLORA, *Benth. l. c.* With the preceding, and near Oakland, California; April.

NEMOPHILA ATOMARIA, *Fisch. & Meyer; DC. l. c.* Borders of fields, Corte Madera; April.

NEMOPHILA MACULATA, *Hartw.; Lindl. in Jour. Hort. Soc.* 3, *p.* 319. Hill-sides, Duffield's Ranch, Sierra Nevada; May. A handsome species, now often seen in cultivation.

NEMOPHILA AURITA, *Lindl. Bot. Reg. t.* 1601. Banks of the Stanislaus, at Robinson's Ferry; May.

NEMOPHILA INSIGNIS, *Benth. l. c.* N. liniflora, *Fisch. & Meyer, Hort. Petrop.* Cajon Pass; March.

PHACELIA TANACETIFOLIA, *Benth. Hydrophyll. l. c.* Los Angeles, San Francisco, etc.; March, April. Various forms.

PHACELIA CIRCINATA, *Jacq. Ecl.* 1. *t.* 91; *Benth. l. c.* Hill-sides at Murphy's, and in many other places in California; May.

PHACELIA CILIATA, *Benth. l. c.* Los Angeles, and on the Great Colorado; February, March.

EUTOCA DIVARICATA, *Benth. l. c.* Near the Redwoods of California; April.

POLEMONIACEÆ.

PHLOX OCCIDENTALIS (Durand, Mss.): glanduloso–puberula; caulibus adscendentibus (subpedalibus); foliis lanceolatis rigidulis mucronatis; pedunculis erectis brevibus; calyce viscido corollæ tubo paullo breviore, dentibus subulatis erectis tubo æquilongis; corollæ (albæ?) lobis late obcordatis contiguis; ovarii loculis uniovulatis. P. divaricata, *Durand, Pl. Pratten in Journ. Acad. Philad. n. ser.* 1855. Hill-sides, near Duffield's Ranch, May. Lower leaves not seen; the upper 12–16 lines long, 2 or 3 wide, usually broadest at the base. Limb of the corolla an inch in diameter, the broad and rounded rather deeply obcordate lobes overlapping each other, not widely separate as in P. divaricata (in which, however, the lobes vary from strongly obcordate-notched to barely retuse). Ovules solitary. Root doubtless perennial. The only species of the first section of the genus known west of the Rocky Mountains.

COLLOMIA GRACILIS, *Benth. in Bot. Reg., & in DC. Prodr.* 8, *p.* 308. Corte Madera and Sonoma; April, May.

COLLOMIA GLUTINOSA, *Benth. l. c.* Sonora, California, along rivulets and ravines; May. A form with the corolla longer than usual; its slender tube half an inch long, and thrice the length of the calyx.

NAVARRETIA HETEROPHYLLA, *Benth. in DC. l. c.* Collomia heterophylla, *Hook.* Mokelumne Hill, and Grass Valley, California; May.

NAVARRETIA PUBESCENS, *Hook. & Arn. Bot. Beech. p.* 368. Ione Valley, in low places; also Knight's Ferry on the Stanislaus, on hill sides; May.

NAVARRETIA COTULÆFOLIA, *Hook. & Arn. l. c.* With the last.

NAVARRETIA LEUCOCEPHALA, *Benth. Pl. Hartw. p.* 324. Low and wet places, Mark West's Creek, California; April 30.

GILIA CAPITATA, *Dougl. in Bot. Mag. t.* 2698. Hill-sides, Sonoma, California; May.

GILIA ACHILLEÆFOLIA, *Benth. in Bot. Reg. & DC. l. c.* Knight's Ferry on the Stanislaus; May.

GILIA TRICOLOR, *Benth, l. c.* Hill-sides, Martinez; April. From Napa Valley are specimens gathered April 16, wholly in fruit, which appear to be either G. tricolor or G. multicaulis, but with the calyx and peduncles glabrous.

GILIA (LINANTHUS) DICHOTOMA, *Benth. in DC. l. c.* Napa Valley, and near San Francisco; April. This and all the sections (formerly genera) of Bentham, with palmatisect usually opposite leaves, we should prefer to regard as one genus, leaving to Gilia the sections Eugilia, Thyrsogilia (of which G. congesta is the type), and Ipomopsis.

GILIA (LINANTHUS) DIANTHOIDES, *Endl. Atakt. t.* 29; Cocomungo, California; in sandy or gravelly places; March.

GILIA (DACTYLOPHYLLUM) PHARNACEOIDES, *Benth. in DC. l. c.* Hill-sides, Napa Valley; April.

GILIA (LEPTOSIPHON) ANDROSACEA, *Steud.; Benth. l. c.* Plains and hill-sides, Napa Valley, etc. April, May.

GILIA (LEPTOSIPHON) CILIATA, *Benth. Pl. Hartw., p.* 324. Hill-sides and grassy plains, Napa Valley, California; May.

GILIA (LEPTOSIPHON) MICRANTHA, *Steud.; Benth. l. c.* Hill-sides, Napa Valley; May: and Benicia, California; April.

GILIA MICRANTHA, var. AUREA, *Benth. Pl. Hartw. l. c.* Hills and plains, Napa Valley; April. The stamens nearly equal in length the lobes of the corolla, which is yellow; otherwise the same as G. micrantha.

GENTIANACEÆ.

FRASERA NITIDA, *Benth. Pl. Hartw. p.* 322. Hill-sides, near Marysville, California; May, Capsule, 4-seeded. Seeds linear-oblong, winged. We have specimens of this species in fruit, collected in California by Mr. Shelton. It is scarcely distinct from F. albescens.

FRASERA PANICULATA (n. sp.): foliis linearibus oppositis; panicula pyramidata nuda laxa; calycis segmentis ovatis acutis corollam duplo brevioribus; foveis oblongo-linearibus binis; corona nulla. Sand-bluffs, Inscription Rock, Zuñi county. Specimens were collected very late in the season, but they are sufficient to show that this is quite a new species. The plant is nearly three feet high, with a long tapering root. Radical leaves in a cluster; stem leaves in three distant pairs. Panicle (fructiferous) about two feet long, loose, compound; pedicels an inch or more in length. Segments of the corolla oblong, obtuse, furnished near the base with two narrow pits, which are nearly half the length of the segment, and are pectinately ciliate around the margin. Filaments somewhat dilated downward, distinct. Capsule about three-fourths of an inch long, very slightly compressed. Seeds 15–20, completely filling the capsule. scabrous, wingless.

As Mr. Bentham remarks, (in Plant. Hartw.) Grisebach's character of the genus Frasera does not agree with the western species, and seems to have been drawn from F. Carolinensis, which is destitute of a corona. This is the more remarkable, as Grisebach elaborated the Gentianaceæ for Hooker's Fl. Bor.-Amer., and described in that work, two species, which are furnished with a conspicuous corona, consisting of fimbriate scales, alternating with the stamens. Our new species agrees with the eastern one in wanting the crown. Dr. Parry found on the mountains east of San Diego another species (F. Parryi, *Torr. Bot. Mex. Bound. Surv., ined.*) still more

like F. Carolinensis, and likewise destitute of a crown. It is, perhaps, F. verticillata, *Hook. Fl. Bor.-Am.*, but not of Walter. It has a nearly naked panicle, and lunate solitary glandular pits.

ERYTHRÆA MUHLENBERGII, *Griseb. in DC. Prodr.* 9, *p.* 60, quoad pl. Calif. Fields, Benicia; April.

MENYANTHES TRIFOLIATA, *L.* Near San Francisco; April.

CONVOLVULACEÆ.

CONVOLVULUS CALIFORNICA, *Choisy in DC. Prodr.* 9, *p.* 405. Santa Rosa creek, California; May 1.

IPOMÆA SAGITTATA, Desf.? I. sagittifolia, *Hook. & Arn. Bot. Beech. p.* 151. Hills near Punta de los Reyes, California; April 17. This is probably the plant of Hooker and Arnott, but not Convolvulus sagittifolius, *Michx.* The leaves are broader, and the auricles are deeply emarginate, or even 2-lobed at the summit. The one-flowered peduncles are longer than the leaves, and furnished with two small alternate lanceolate bracts a short distance below the flower. Corolla nearly as large as in Calystegia sepium, whitish, with pale purple stripes.

CONVOLVULUS ARVENSIS, *Linn.; Choisy in DC. Prodr.* 9, *p.* 406; var. VILLOSUS, *Choisy l. c.* Hill sides, Sonora, California; May 9. Stems prostrate, branching from the root. Leaves varying from ovate to narrowly lanceolate, strongly hastate or sagittate. Peduncles longer than the leaves, with a pair of opposite lanceolate mostly sagittate bracts a little below the flower.

CONVOLVULUS (n. sp.?): canescenti-tomentosus; caule prostrato e basi ramoso; foliis lato-cordatis brevissime acuminatis, auriculis angulari-bilobis; pedunculis unifloris axillaribus. Hill-sides, Downieville, Yuba river, California; May 22. Our specimens have only young flower buds, so that the genus cannot certainly be ascertained. The plant has never come under our observation before.

CUSCUTA CALIFORNICA, *Hook. & Arn. Bot. Beech. p.* 364; *Choisy in DC. Prodr.* 9, *p.* 457. Parasitic on Phacelia circinata and other plants, in various parts of California; February, May.

SOLANACEÆ.

SOLANUM UMBELLIFERUM, *Eschsch. Mem. de St. Petersb.* 10, *p.* 280, *and in Linnæa*, 1828, (*litt.*) *p.* 148; *Dunal in DC. Prodr.* 13, *pars.* 2, *p.* 93. S. Californicum, *Dunal. l. c. p.* 86. Cocomungo, March 17, and San Francisco; April 3. A common species in California. It varies much in the size and form of the leaves, degree of the pubescence, and number of flowers in the raceme or umbel.

NICOTIANA QUADRIVALVIS, *Pursh Fl.* 1, *p.* 141; *Dunal in DC. Prodr.* 13, *pars.* 1, *p.* 571. N. multivalvis, *Lindl. Bot. Reg. t.* 1057? Rocky arroyos, near the Colorado of the West; February 17.

NICOTIANA PLUMBAGINIFOLIA, *Dunal in DC. Prodr.* 13, *pars.* 1, *p.* 569. Var? BIGELOVII: annua; caule glanduloso-pubescente subsimplici; foliis oblongo-lanceolatis acutiusculis glabriusculis, inferioribus in petiolem angustatis, superioribus sessilibus basi angustatis; panicula terminali laxiuscula; calyce glanduloso-pubescente, laciniis lanceolato-linearibus inequalibus, corolla hypocraterimorpha, tubo elongato calyce 2–3-plo longiore, limbi laciniis lato-ovatis obtusiusculis. Knight's Ferry, Stanislaus river; May. We are unwilling to propose this as a new species, since there are so many others in the same genus that are very imperfectly known. Our plant does not agree with any Nicotiana described by Dunal, (l. c.,) but it seems to approach the nearest to N. plumbaginifolia.

LYCIUM, "n. sp. near L. FRAGROSUM," *Miers in lit.* In cañons along Williams' river, February 8. Mr. Miers will describe this new species in a monograph of Lycium that is to appear in the second volume of his Illustrations of South American Plants, shortly to be published.

ASCLEPIADACEÆ.

Asclepias ericoarpa, *Benth. Pl. Hartw. p.* 323, *No.* 1835. Hill-sides, Knight's Ferry, Stanislaus river, California; May 7.

Asclepias (Otaria) n. sp.? Dry arroyos, on the Great Colorado of California. Our specimens are imperfect, having been gathered late in the season, when the leaves had fallen. The plant evidently belongs to the section Otaria of Decaisne, but we can refer it with certainty to none of the species described in the Prodromus. It is tall, (apparently 3–4 feet high,) somewhat branched above, with a minutely pubescent stem. The umbels are numerous, in a terminal panicle or raceme, 15–20-flowered. The flowers are apparently white, about as large as in A. variegata. The petals are reflexed, and the oblong entire cuculli are only about one-third longer than the sessile gynostegium. Horn subulate-falciform, slightly exserted. The pod is about 5 inches in length, even, oblong, tapering to a long point. It seems to be nearly allied to A. subulata of Decaisne, but that is said to have the cuculli twice as long as the gynostegium, and until the leaves are known we cannot be sure that it is a new species.

Acerates cordifolia, *Benth. Pl. Hartw. p.* 323. Knight's Ferry, Stanislaus river, California; May 8. We have this plant also from the Rev. Mr. Fitch. In all our specimens the gynostegium is much shorter than the corolla. The cuculli are about the length of the gynostegium, obliquely truncated downward, and closely appressed to the processes of the anthers.

OLEACEÆ.

Fraxinus pistaciæfolia: glabra seu tomentuloso-velutina; foliolis 2–4-jugis subpetiolulatis ovatis oblongis lanceolatisve serratis vel fere integerrimis pallidis vel supra lucidis venosis; petiolo canaliculato nunc apicem versus marginato; samara ex apice in alam spathulato-oblongam portione seminifera subtereti immarginata vix longiorem producta. F. velutina, *Torr. in Emory's Rep.* (forma tomentosa.) Rocky ravines of Williams' River; January 3: fruit only. A species occurring in almost all the New Mexican collections, excessively variable in its foliage, and so much more generally smooth than pubescent (still less velvety) that we propose to supersede the little-known name under which an extreme form of it was briefly described in Emory's Report some years ago.

Fraxinus Oregona, *Nutt. N. Amer. Sylv.* 3, *p.* 59, *t.* 99. F. pubescens, *var. Hook. Fl. Bor.-Am.* 2, *p.* 51. F. grandifolia, *Benth. Bot. Sulph. p.* 33. Napa Valley, California, in deep ravines and along rivulets; May 5. A small-leaved form.

ARISTOLOCHIACEÆ.

Aristolochia Californica (sp. nov.): caule volubili fruticoso; foliis ovato-cordatis integerrimis membranaceis utrinque pubescentibus; pedunculis solitariis medio unibracteatis; perianthio glabriusculo inflato, limbo trilobo, lobis fere æqualibus subconniventibus. Near Corte Madera, California; April 16, (in flower.) A tall climbing species. Leaves 3–4 inches long, obtuse, velvety-pubescent when young, thinly but softly pubescent when mature. Peduncles an inch and a half or two inches in length, thickened and pubescent under the flower, furnished near the middle with a small ovate bract. Flower dull purple at the base and tip, paler in the middle, about an inch and a half long from the base to the curvature. This rare plant (which we have only received besides from Dr. Hulse, who collected it in the Sacramento valley) resembles A. tomentosa, *Nutt.;* but that has naked peduncles and narrow villous flowers, the lobes of which are widely spreading.

Asarum Hookeri, *Fielding, Sert. Plant. fol. & t.* 32. A. Canadense, *β. Hook. Fl. Bor.-Amer.* 2, *p.* 139. Hill-sides and low places, Downieville, Yuba; Duffield's Ranch, and mount-

ains near Oakland, California; March—April. The specimens from all these stations have the lobes of the flower furnished with a long caudate acumination, and the leaves are much more glabrous than in A. Canadense; but Bentham (*Pl. Hartweg, p.* 335) says that specimens from the mountains of Sacramento are more like the eastern A. Canadense, of which he thinks the Californian plant may be only a variety.

CHENOPODIACEÆ.

Teloxys cornuta (n. sp.): foliis repando-dentatis pinnatifidisque calycis laciniis acutis dorso brevi-rostellatis, semine compresso margine obtusissimo. Rocky places, Hurrah creek, New Mexico. Near San Francisco mountain, Western New Mexico, *Dr. Woodhouse*, (omitted by accident in the botany of Sitgreaves' report); Wright's Coll., No. 1735. Gregg collected the plant near Saltillo, Mexico, (No. 390.) T. aristata differs in the entire leaves, inappendiculate glabrous calyx with obtuse segments, and acutely margined lenticular seeds. T. cornuta is commonly about a foot or 15 inches high, and is often very much branched. The leaves are deeply pinnatifid, with 2–3 distant lobes on each side. The calyx is beset with minute elevated glands, and on the upper part of the back of each segment is a short acute spine or tooth, so that in fruit the calyx appears somewhat stellate. The seed is exactly orbicular, thick, rounded on the margin, and closely covered with the utricle, which strongly adheres to its surface. In T. aristata the utricle separates spontaneously from the seed.

The genus Teloxys was established by Moquin on Chenopodium aristatum, and has hitherto consisted of that species only. Linnæus, in the second edition of the Species Plantarum, referred to C. aristatum, the Chenopodium Virginicum of his first edition, regarding it as a variety only. Dr. Gray, who saw the original specimens in the Linnæan herbarium, informs me that the plant is nothing more than Suæda maritima; and yet it is difficult to understand how the description of Chenopodium Virginicum, in the Species Plantarum, (ed. 1,) could have been drawn from that plant. The first part of the character ("foliis linearibus obtusis canaliculatis") agrees sufficiently well, but the latter portion ("pedunculariibus axillaribus dichotomis") is quite inapplicable. We greatly doubt whether a Teloxys has ever been found in any of the older United States. Moquin (in DC. Prodr.) states that he has seen Mexican specimens of T. aristata in the Vienna herbarium, but it is more than probable that the plant which he refers to is our T. cornuta. Without the leaves, (which fall away late in the season,) the two species are not distinguishable except by the use of a lens.

Cycloloma platyphyllum, *Moq. Chenop. p.* 18, *& DC. Prodr.* 13, *pars* 2. *p*, 60. Salsola platyphylla, *Michx.* Sand-hills of the Canadian River; September: flowers and fruit.

Chenopodium album, *Linn.* Alluvions of the Upper Canadian; September C. subspicatum, *Nutt.* is hardly distinct.

Chenopodium hybridum, *Linn.; Moq. in DC. l. c. p.* 68. With the last.

Blitum capitatum, *Linn.; Moq. l. c. p.* 83. Ravines, Sandia mountains, New Mexico; October. It is difficult to believe that the last three species could have been introduced into a region so far removed from settlements of the whites.

Blitum Bonus-Henricus, *Reich.; Moq. in DC. Prodr.* 13, (*pars* 2,) *p.* 85; *Torr. Fl. N. York* 2, *p.* 136. Plains and banks of the Sacramento, California; April 24.

Obione lentiformis, *Torr. in Sitgreaves' Report, p.* 169, *t.* 14, *β* rhombifolia: foliis rhomboideo-ovatis undulatis. On Williams' River of the Colorado of California; February, (with fruit of the preceding autumn.) This species forms impenetrable thickets twelve feet high! The leaves are much larger than in the specimens collected in Captain Sitgreaves' expedition.

Obione hymenelytra, *Torr. in Emory's Rep. of Mex. Bound. Surv.* (*ined.*) (Tab. XX.) Hills and gravelly places, on Williams' River. This species was found by Dr. Parry and by Colonel Fremont on the Gila. It is remarkable for its large broad membranaceous fruit-bracts, and roundish-deltoid coarsely and sharply toothed leaves.

OBIONE POLYCARPA, *Torr.* (*in Emory's 1st Report, p.* 149, *sine char.*): suffruticosa, ramosissima; ramulis gracilibus paniculatis; foliis minutis sessilibus obovato-oblongis obtusis integerrimis albido-farinosis; bracteis orbicularibus, supra mediam distinctis argute grosse-dentatis, utrinque cristatis. With the preceding. Leaves 3–5 lines long, crowded. Fruit abundant, aggregated on the long slender branchlets. Fructiferous bracts about 2 lines in diameter.

OBIONE CANESCENS, *Moq. l. c. p.* 212. Llano Estacado; September; fruit. The specimens belong to the form with broadly winged fruit-bracts.

OBIONE ARGENTEA, *Moq. l. c. p.* 115. Atriplex argentea, *Nutt. Gen.* 1, *p.* 198. Upper waters of the Canadian; with ripe fruit, in which state it is seldom collected. The fructiferous bracts are somewhat orbicular, the margin deeply and acutely toothed, and the disk is often more or less cristate with leafy appendages.

EUROTIA LANATA, *Moq. l. c. p.* 121. Diotis lanata, *Pursh, Fl.* 2, *p.* 602. With the last, abundant; September. Hooker refers this to E. ceratoides, but we are inclined to regard it as a distinct species.

CORISPERMUM HYSSOPIFOLIUM, *Linn.; Moq. l. c., p.* 140. C. hyssopifolium, *Nutt. Gen.* 1, *p.* 4. Sandy ravines on the Canadian; also banks of streams, Galisteo, New Mexico; September, October.

SUÆDA MARITIMA, *Dumort.; Torr. Fl. N. York,* 2, *p.* 141. Chenopodina maritima, *Moq. in DC. Prodr.* 13, *pars* 2, *p.* 161. Salsola depressa, *Pursh, Fl.* 1, *p.* 197, *excl. syn.* Wet saline soils along the Canadian River; August, September.

SUÆDA FRUTICOSA, *Forsk.; Moq. l. c. p.* 156. Var.? MULTIFLORA: floribus 6–10 glomeratis, foliis carnosis compressis. Llano Estacado. A shrubby much branched plant, apparently 3–4 feet high. The branches are of a light-brown color, and marked with little knobs, the cicatrices of fallen leaves. Lower leaves not seen; those of the primary branches are nearly half an inch long, and more than half a line wide, compressed, (not semiterete.) The flowers are very numerous, and are crowded on the axils of the leaves. Sepals oblong, a little fleshy, concave and somewhat cucullate at the extremity, the narrow margin scarious. Seeds horizontal and vertical in the same plant, black and shining, with a short rostrum. We fully agree with Fenzl (in Ledeb. Fl. Ross. 3, p. 777) in restoring Chenopodina to Suæda—the only character on which the former genus was founded being inconstant. There are several other species of Suæda, in which both vertical and horizontal seeds are found on the same plant.

SARCOBATUS VERMICULARIS, *Torr. in Emory's Rep. p.* 150, and in *Sitgreaves' Rep. p.* 169. Batis? vermicularis, *Hook.* Alluvions of the Rio Grande, near Albuquerque; October; in fine fruit.

AMARANTHACEÆ.

MONTELIA TAMARISCINA, *Gray. Man. ed.* 2, *p.* 370. Amaranthus tamariscinus, *Nutt. in Trans. Amer. Phil. Soc.* (2*d ser.*) 5, *p.* 165. Wet ravines, Deer creek, Indian Territory; August.

AMARANTUS ALBUS, *Linn.; Moq. in DC. Prodr.* 13, *pars* 2, *p.* 264. Sandy ravines near the Canadian River; September.

AMARANTUS RETROFLEXUS, *Linn.; Moq. l. c., p.* 258. A. græcizans, *Torr. Fl. N. York* 2, *p.* 144. Ravines near Santa Antonito, New Mexico; and prairies (especially around marmot burrows) along the Canadian River; September, October.

GOSSYPIANTHUS TENUIFLORUS, *Hook. Ic. t.* 251; *Moq. l. c., p.* 337. Dry prairies near the Cross Timbers of the Canadian River. Root-stock stout and dark colored, branching into several short heads. Stems numerous prostrate 3–4 inches long. Leaves a little pubescent underneath. Filaments very thin and translucent.

FRŒLICHIA GRACILIS, *Moq. l. c. p.* 420. Dry prairies and rocky places along the Canadian to the Rio Grande. On Hurrah creek a dwarf form (1–4 inches high) was found, in which the inflorescence was reduced to a single terminal cluster or head.

Frœlichia floridana, *Moq. l. c.* Oplotheca floridana, *Nutt. Gen.* 2, *p.* 79; *Bart. Fl. N. Amer.* 2, *t.* 59; *Hook. Ic. t.* 256. Sand banks of the Canadian; August. F. Drummondii of Moquin seems to be scarcely a variety of this species. The fructiferous calyx has a narrowly winged and irregularly toothed margin. At the base there is usually a central tooth or protuberance on one side, and two protuberances on the other. The same characters occur in F. gracilis.

NYCTAGINEÆ.

Oxybaphus glabrifolius, *Vahl, Enum.* 2, *p.* 40; *Choisy in DC. Prodr.* 13, (*pars* 2,) *p.* 431. O. lævis, *Benth. Bot. Sulph. p.* 44. Los Angeles; March 21; and mountains near the Colorado, Mexico.

This species is very variable in its pubescence. If O. lævis of Bentham be correctly referred here, it is sometimes wholly glabrous. Our California specimens usually have the branches, peduncles, and margin of the leaves slightly pubescent. Those from near the Colorado have the branches strongly pubescent, and both surfaces of the leaves more or less so. The perianth is rose-colored, and the 5 lobes are emarginate.

Quamoclidion oxybaphoides, *Gray in Sill. Jour.*, 2*d ser.* 15, *p.* 320. Rocky places, Llano Estacado; September. The involucre is unequally 4–5 cleft. Fruit black when dried before ripening, but mottled when mature.

Abronia cycloptera, *Gray l. c., p.* 319. A. (Tripterocalyx) micrantha, *Torr. in Frem. 1st Rep*, *p.* 96. Banks of the Rio Grande, near Albuquerque, New Mexico; October; with flowers and fruit, the latter more than an inch in length, with very broad membranaceous wings.

Abronia mellifera, *Dougl. in Hook. Bot. Mag. t.* 2879; *Moq. in DC. Prodr.* 13, (*pars* 2,) *p.* 435. Sandy hills, Indian Territory; September; with flowers and ripe fruit; and sandy hills near the Colorado, California; February. The figure in the Botanical Magazine (copied by Lindley, *Veg. Kingd.*) erroneously shows the embryo with two cotyledons. We have shown, elsewhere, that in all the species of Abronia, the inner cotyledon is either wholly suppressed, or only rudimentary. Near Galisteo, New Mexico, Dr. Bigelow collected a dwarf variety of A. mellifera, with spatulate leaves tapering at base to a long petiole, and large membranaceous involucres with broadly ovate segments. The fruit resembled that of the ordinary form.

Abronia arenaria, *Menz. in Hook. Exot. Fl. t.* 193; *Choisy in DC. Prodr.* 13, (*pars* 2,) *p.* 435. Sand-hills near the sea-shore, Punta de los Reyes, California; April 17.

POLYGONACEÆ.

Eriogonum polifolium, *Benth. in DC. Prodr.* 14, *pars* 1, *p.* 12. Mountain aroyos near Williams' River; February 9. Involucres usually in a capitate cluster, but sometimes on short rays.

Eriogonum corymbosum, *Benth. l. c.* Var. divaricatum, *Torr. & Gray, in Beckwith's Rep., p.* 123. On sandy hills, near Inscription Rock, Western New Mexico; November 18.

Eriogonum longifolium, *Nutt. in Trans. Amer. Phil. Soc. n. ser.* 5, *p.* 164. Dry prairies, Upper Cross Timbers of the Canadian River; August.

Eriogonum orthocladon, *Torr. in Sitgreaves' Rep. p.* 167, *t.* 9; *Benth. in DC. Prodr.* 14, *pars.* 1, *p.* 15. Sandy hills, Albuquerque, New Mexico.

Eriogonum alatum, *Torr. l. c. p.* 168, *t.* 8. Var. glabriusculum: caule foliisque vix pube. scentibus; involucris bracteolisque glabris. High prairies, near the Upper Canadian. Plant 4–5 feet high. Differs from the ordinary form of this species in being taller, nearly glabrous in all its parts, (except a slight hairiness on the leaves and lower part of the stem,) and in the slender and more numerous branches. It may be E. alatum β. elatum, *Benth. in DC. Prodr.* 14, *pars.* 1, *p.* 7.

Eriogonum lachnogynum, *Torr. mss.; Benth. l. c. p.* 8. (Tab. XIX.) Hill-sides and rocky dells of the Llano Estacado; September. A remarkable species. At the base of each flower there is an ovate-lanccolate bract, (not represented in the figure,) and inside this a pair of spatulate-linear opposite bracteoles. This appears to be the normal structure in the genus, but we have not detected it in any other species. Usually the bracteoles are solitary, or more rarely, a pair of opposite ones to each flower.

Eriogonum Wrightii, *Torr. Mss.; Benth. l. c. p.* 15. Gravelly plains, near Albuquerque, New Mexico; October. Stem suffruticose, decumbent, throwing up erect branches which are 6–12 inches high. Flowers very numerous, many of them expanding together, and thus forming heads which are more than half an inch in diameter. Involucre acutely 5-toothed. Segments of the perianth obovate, the exterior a little broader than the others; ovary and achenium with the beak hispid.

Eriogonum Jamesii, *Benth. in DC. Prodr.* 14, *pars* 1, *p.* 7. Hills on the upper waters of the Canadian River. September.

Eriogonum tenellum, *Torr. Ann. Lyc. N. York*, 2, *p.* 241; *Benth. l. c. p.* 19. With the last; in rocky places.

Eriogonum rotundifolium, *Benth. l. c. p.* 21. Sandia mountains, New Mexico; October. Bractcoles 2, spatulate-linear, glandular on the margin, and fringed also with long hairs.

Eriogonum effusum, var. leptophyllum, *Torr. in Sitgreaves' Rep. p.* 168. Hills and ravines, Cienegella, New Mexico; October.

Eriogonum effusum, var.? nudicaule: caule brevissimo ramoso basi lignoso; foliis subradicalibus lanceolato-linearibus albolanatis, scapis glabriusculis superne bis bi-trichotomis, involucris turbinato-campanulatis glabris 5-dentatis, dentibus rotundatis brevibus, perigoniis glabris, basi obtusis, laciniis oblongis subæqualibus; ovario glabro. In pine and cedar woods; near Galisteo, New Mexico. Branches of the stem or caudex scarcely an inch long. Leaves 2 inches long, 2–3 lines wide, revolute on the margin (in the dry specimens), tomentose on both sides, but less so above. Scapes 8–12 inches high, naked, mostly twice three-forked with very short bracts at the base of the somewhat spreading branches. Perianth pale purple, segments emarginate, the exterior ones a little broader. Achenium ovate with a long tapering summit, slightly scabrous on the angles above. Embryo incurved-excentric. This resembles some forms of E. effusum, especially the var. rosmarinoides, *Benth.*, but differs in the very short stem, nearly glabrous elongated scapes or peduncles and involucres, looser and more spreading inflorescence. Its habit is that of E. lachnogyuum, but it belongs to a different section, the embryo being strongly curved.

Eriogonum polycladon, *Benth. l. c. p.* 16. Gravelly hills, near Albuquerque, New Mexico; October. Annual. Bracteoles filiform, not glandular, with very long fringed hairs on the margin.

Chorizanthe membranacea, *Benth. in Linn. Trans.* 17, *p.* 419, *t.* 17, *f.* 11. Hill-sides, etc., Knight's Ferry, Stanislaus River; also near Sonora, California; May.

Chorizanthe pungens, *Benth. l. c. t.* 19, *f.* 2. With the preceding species, May 8.

Pterostegia drymarioides, *Fisch. & Mey. Ind. Sem. Hort. Petrop.* 1835; *Hook. & Arn. Bot. Beech. p.* 387, *t.* 90. Rocky places, near Marysville; also at Knight's Ferry, Stanislaus River; Napa Valley; and mountains near San Gabriel, March—May. This plant is variable in the size and divisions of the leaves. In the specimens from near San Gabriel the leaves are deeply two-parted, and the divisions two-cleft, with entire or bifid segments. We have little doubt that among its forms must be included P. diphylla and P. microphylla.

ACANTHOGONUM, Nov. Gen.

Involucrum 1–2-florum, tripartitum, basi indurata subtrigonum, segmentis inæqualibus ovatis lanceolatisve apice subulato-pungentibus. Flos hermaphroditus sessilis, ima basi involucri

reconditus. Perigonium æqualiter 6-dentatum, fructiferum clausum. Stamina 6, perigoni fauc inserta, dentibus ejusdem opposita: filamenta brevissima. Styli 3, breves; stigmata capitata. Achenium ovato-trigonum, acutum, semen conforme. Embryo in axi albuminis farinacei curvatum; cotyledonibus orbiculatis planis; radicula elongata supera. Herba annua, nana, breviter ramosa, rigida; foliis imis ovatis longe petiolatis tomentosis, reliquiis spinescenti-subulatis confertissimis patentibus exstipulatis; involucris axillaribus sessillibus bracteola trifida spinescente fulcratum.

Acanthogonum rigidum. On Williams' river, a fork of the Colorado, Western New Mexico. Only winter vestiges of this plant were collected by Dr. Bigelow; but the specimens seem to show that it is a new genus of Eriogoneæ. It will stand next to Mucronea, from which it differs in habit, in the short involucral tube, in the 6-toothed closed perianth, and in the insertion of the stamens. The whole plant above ground is not more than 3 or 4 inches high. The lower and radical leaves are about half an inch long, clothed with a white tomentum, and stand on petioles which are nearly an inch in length. The upper leaves are destitute of stipules, rigid, subulate, and spreading. In nearly every axil is a solitary sessile involucre, which is 3-parted; the segments varying from ovate to narrowly lanceolate; all of them mucronate and pungent, carinate, strongly 3-nerved, with transverse connecting veins; the closed base is obtusely triangular, and contains a single sessile flower. Perianth membranaceous, 6-toothed; the teeth ovate, very hairy. Stamens apparently only 6; filaments inserted in the throat opposite the teeth of the perianth; anthers not seen. The achenium is sometimes 3-valved at the summit, or at least easily splits when old. What we have called subulate rigid upper leaves may be only the spine-like persistent midribs.

Rumex maritimus, *Linn.; Meisn. in DC. Prodr.* 14, *pars* 1, *p.* 59. Low places on the Rio Grande, near Albuquerque. A dwarf form.

Rumex domesticus, *Hartm.; Hook. Fl. Bor.-Amer.* 2, *p.* 129? Sandy plains and hills near the Mohave creek, California; March. The fruit too young for determining with certainty the species.

Polygonum Paronychia, *Cham. & Schlecht. in Linnæa.* 3, *p.* 51; *Hook. & Arn. Bot. Beech.*, *p.* 158. Near San Francisco; April 3.

Polygonum Bistorta, *Linn.; Meisn. Polyg. p.* 91. P. bistortoides, *Pursh, Fl.* 1, *p.* 371. Laguna of Santa Rosa creek, New Mexico; May 1.

LAURACEÆ.

Oreodaphne Californica, *Nees, Syst. Laur. p.* 463. Tetranthera? Californica, *Hook. & Arn. Bot. Beech. p.* 150. Laurus? regia, *Dougl. in Hook. Comp. Bot. Mag.* Umbellularia Californica, *Nutt. Sylv.* 1, *p.* 87. Drimophyllum pauciflorum, *Nutt. l. c. t.* 22, *excl. syn.* Mountains near San Gabriel, and Oakland, California; March—April, (in flower.) On the Upper Sacramento this fine tree attains a height of 50–70 feet. Douglas estimated the height of some individuals at 120 feet. Towards the south its altitude is much less, being from 15–30 feet. By the slightest friction it emits a strong spicy odor, but is apt to excite sneezing. The fruit is globose, nearly an inch in diameter, and stands on a thick stalk. When immature it is green, but dark-purple when fully ripe. We have no doubt that Nuttall's Drimophyllum is identical with Oreodaphne Californica. His plate agrees very well with a common state of the plant, and also with an authentic specimen of Laurus regia of Douglas. The inhabitants of California call it Mountain Laurel and Spice-tree. It grows throughout the western part of the State, from the borders of Oregon to Santa Barbara.

THYMELACEÆ.

Dirca palustris, *Linn. Spec.* 1, *p.* 358; *Torr. Fl. N. York* 2, *p.* 163. Mountains near Oakland, California; April 4, (with flowers and young fruit.) We have never before received this plant from any part of the United States west of the Mississippi.

SANTALACEÆ.

COMANDRA UMBELLATA, *Nutt. Gen.* 1, *p.* 157; *Hook. Fl. Bor.-Amer.* 2, *p.* 139, *t.* 179, *fig. A; Torr. Fl. N. York* 2, *p.* 160. Hill-sides, Sonora, California; May 9. This plant has a very extensive range both in latitude and longitude, being found from British America to Georgia and Texas, and from the Atlantic to the Pacific. In the south, and far to the west, it is often suffrutescent, which is not the case in the middle States. Mr. Stauffer, of Mount Joy, Pennsylvania, has clearly established the parasitism of Comandra to be similar to that which M. Mitten had previously ascertained of Thesium.

LORANTHACEÆ.

PHORADENDRON FLAVESCENS, *Nutt. in Jour. Acad. Phil. n. ser.* 1, *p.* 185; *Engelm. in Gray Pl. Fendl. p.* 59. Viscum flavescens, *Pursh, Fl.* 1, *p.* 114. V. Reichenbachianum, *Seem. Bot. Herald. p.* 294 *t.* 62. On Williams' River; February. The anthers are only one-celled, with a transverse terminal slit.

Var. PUBESCENS, *Engelm. in Gray, Pl. Lindh.* 2, *p.* 212. Parasitic on Quercus agrifolia. Napa Valley, Corte Madera, &c., California. Differs from the ordinary form of P. flavescens only in its pubescence, and smaller leaves.

Var. ORBICULATUM, *Engelm. l. c.* Pass of Mount Hope, and near White Cliff Creek, Western New Mexico; on Quercus Emoryi. Fruit ripe in January. Dr. Bigelow found at Cajon Pass, on what seems to be a dwarf oak, a Phoradendron with ovate nearly sessile and very thick leaves, which are scarcely more than half an inch in length, and clothed (as well as the young branches) with a dense pubescence. There were only a few separate berries accompanying the specimens. It may be P. villosum of Nuttall. Our materials are scarcely sufficient for identifying the species.

PHORADENDRON PAUCIFLORUM (n. sp.): ramis teretibus; foliis spathulatis v. spathulato-linearibus enerviis junioribus pubescentibus demum glabratis crassis; spicis brevipedunculatis simplicibus capitatis oblongisve pauci-(4–8)-floris foliis multo brevioribus; floribus plerumque 3-lobis. On Juniperus occidentalis and Abies Douglasi, Duffield's Ranch, Sierra Nevada. Branches 3–6 inches long, stout. Leaves three-fourths of an inch to an inch long, 2–3 lines wide. Anthers 2-celled, opening by two terminal transverse chinks. There is an abortive ovary with a distinct style in the male flowers. Berries apparently white, about one line in diameter in the dried specimens. This seems to be a widely spread species. Dr. Gregg found it at San Antonio de los Alanzanes, Mexico. It also occurs in Sonora, and Mr. Wright collected it in New Mexico.

PHORADENDRON CALIFORNICUM, *Nutt. l. c.; Engelm. l. c.* Williams' River, growing on Parkinsonia microphylla; also near the Colorado, on Cercidium floridum, bearing fruit in February, probably formed in the autumn of the preceding year. Specimens with small flowers were collected near Fort Yuma by Major Thomas. Branches pubescent when young, but at length nearly or quite smooth. Spikes, in the specimens from the Colorado, three-fourths of an inch long and many-flowered, with several approximated whorls; but often only 4–8-flowered. Berries globose, apparently reddish, about two lines in diameter. Perianth 3–4-lobed. Anthers oblong, 2-celled, adnate by the middle to the calyx; the cells opening longitudinally on their face the whole length of the anther. This species differs in the structure of the anthers from the character of Phoradendum as given by Nuttall and Engelmann. When dry, the whole plant is of a grayish-brown color.

PHORADENDRON JUNIPERINUM, *Engelm. l. c.* On Williams' River; also in the Desert, 50 miles west of the Colorado. It grows on different species of Juniperus. Only fruiting specimens were found. This is a common species in New Mexico, but we have never seen the male flowers.

ARCEUTHOBIUM CRYPTOPODUM, *Engelm. in Gray, Pl. Lindh.* 2, *p.* 214. On Pinus brachyptera. Sierra Madre and Leroux's Spring, near San Francisco mountain, Western New Mexico. Our

specimens are all female, and mostly in fruit. The plant is of a light-brown when dry. Dr. Engelmann (l. c.) was inclined to refer A. Oxycedri of Hooker's Fl. Bor.-Amer. to this species, but seeing that plant in my herbarium, he thought it was probably A. Americana, *Nutt.*

ARCEUTHOBIUM OXYCEDRI, *M. Bieb.?* A. campylopodum, var. macrathron, *Engelm. l. c.?* On Libocedrus decurrens, Duffield's Ranch, California. The female plant only. A foot long, and of a dark-brown when dry. Stems stout; the branches long and slender, somewhat quadrangular above; the length of the joints 2–3 times more than the diameter. Female flowers mostly 3-cleft. From the Rev. A. Fitch we have specimens of what is undoubtedly Engelmann's plant, collected on a Pinus between Stockton and Stanislaus. It is much smaller than the specimens from Duffield's Ranch, and the color is light-brown.

SAURURACEÆ.

ANEMOPSIS CALIFORNICA, *Nutt. in Tayl. Ann. Nat. Hist.* 1, *p.* 136; *Hook. & Arn. Bot. Beech. p.* 390 *t.* 92. Wet places on the Rio Grande, near Albuquerque; October.

CALLITRICHACEÆ.

CALLITRICHE VERNA, *Linn. Sp.* 1, *p.* 6; *Torr. Fl. N. York*, 2, *p.* 170, var. vulgaris, *DC. Prodr.* 3, *p.* 70. In water, near Tamul Pass, California; April 11. Styles twice as long as the fruit.

CALLITRICHE MARGINATA *n. sp.*: fructibus longepedunculatis; carpellis parallelis dorso alato-membranaceis; foliis lineari-spathulatis trinerviis. Muddy places along Mark West's creek, California; April 30. Upper California; *Rev. A. Fitch*, (locality not recorded.) Stem slender, branching, rooting in the mud. Leaves about one-third of an inch long, distinctly 3-nerved. Styles at first spreading, but finally reflexed over the fruit. Peduncles about two-thirds as long as the leaves, spreading or reflexed. Carpels strongly margined, or with a narrow wing on the back from the base to the summit. A well characterized species, resembling C. Nuttallii; *nob.* (C. pedunculosa, *Nutt. in Trans. Amer. Phil. Soc. n. ser.* 5, *p.* 140; not of Arnott, nor C. pedunculata *DC.*), but differs in the winged fruit. In C. Nuttallii the leaves are very obscurely 3-nerved, not veinless, as they are described.

DATISCACEÆ.

TRICERASTES GLOMERATA, *Presl, Rel. Hœnk.* 2, *p.* 88, *t.* 64; *Benth. Pl. Hartw. p.* 335, *No.* 1951. Mokelumne Hill, and sides of rivulets, Sonora, California; May. Our observations on the male flowers of this genus agree with those of Bentham l. c. We have not seen the hermaphrodite flowers which he describes.

EUPHORBIACEÆ.

EUPHORBIA LEPTOCERA, *Engelm. Mss. in herb. Torr.* Prairies of Grass Valley, California; May 20, (fl. and fr.) We regret having mislaid Dr. Engelmann's description of this species. It will, however, be contained in his Monograph of North American Euphorbiæ, which will be published in a few months. The plant has a strong resemblance to E. Peplus, but is more nearly allied to E. commutata, *Engelm.*, (*in Gray's Manal, ed.* 2, *p.* 389,) from which, indeed, it is difficult to distinguish it.

EUPHORBIA MELANADENIA (sp. nov.): caule procumbente ramosissimo herbaceo; foliis breviter petiolatis suborbiculatis inequaliter cordatis crassiusculis integerrimis dense cano-pubescentibus; stipulis minutis; involucris solitariis; glandulis involucri transverse oblongis, appendicibus petaloideis semiorbiculatis; capsulis hirsutis; seminibus lævibus opacis. Low or wet places near San Gabriel, California; March 22. Leaves 2–3 lines in diameter. Glands black in dried specimens, but perhaps very dark purple in the living plant. Capsule without tubercles. This species appears to be annual, and belongs to the group that contains E. herniariodes.

GARRYACEÆ.

GARRYA ELLIPTICA, *Lindl. Bot. Reg. t.* 1686; *Hook. & Arn. Bot. Beech. p.* 390. Rocky arroyos, near White Cliff Creek, a tributary of Williams' River, New Mexico. The specimens in the collection were gathered in February, and are all female, in fruit. The leaves of the flowering specimens are smaller than the ordinary form of this species, and they are not wavy: those of sterile branches are much larger.

GARRYA WRIGHTII (sp. nov.): foliis elliptico-oblongis utrinque acutis mucronatis crassis planis opacis, margine muriculatis; racemis ramosis; bracteis lanceolatis basi connatis interdum foliaceis et vix connatis; floribus in quisque bractea solitariis masculis pedicellatis, fœmineis sessilibus. On rocks, base of San Francisco Mountain, New Mexico. This species is common at the Copper Mines, New Mexico, and is the same as No. 634 of Mr. Wright's collection of 1849, and No. 1789 of the collection made in 1851–'52. It is nearly allied to G. laurifolia, *Benth. Pl. Hartw. No.* 81 *and* 384; but that has rather obtuse and larger leaves, which are of a thinner texture and without the thickened muriculate margin. Endlicher (*Gen. Suppl. I, No.* 1900) has proposed to separate G. Fadyenii, *Hook. Ic. t.* 333, a native of Jamaica, as a genus, under the name of Fadyenia, on account of the sepals cohering at the tip in the male flower, the absence of a free portion of the perianth in the female, and the short thick recurved styles. In his Suppl. IV, No. 1899, he has added four other species from Mexico to this genus. In G. elliptica, however, (the original species,) the sepals cohere at the tip as much as they do in G. Fadyenii, nor have we detected in the pistillate flower of the former, the two teeth or free portion of the calyx described by Lindley; and the styles are more or less recurved in all the species. The genus Fadyenia is, therefore, without a distinctive character. G. Wrightii is easily distinguished by the roughish, slightly muriculate margin of the leaves. It is a shrub about three feet high. The leaves are $1\frac{1}{2}$–2 inches long, and from three-fourths to nearly an inch wide, with a strongly mucronate tip.

Colonel Frémont found on the Upper Sacramento, "above the Great Cañon," in 1846, a Garrya nearly allied to this species. It may be thus characterized:

GARRYA FREMONTII: foliis lato-ellipticis utrinque acutis vix mucronatis planis glabris supra nitidis margine integerrimis; racemis (♂) ramosis; bracteis ovatis acuminatis supra medium connatis, inferioribus 3-floris; floribus pedicellatis. A shrub about four feet high. Only the male plant was found. The leaves are broader than in G. Wrightii, and are only slightly hairy in the youngest state. The spikes are 2–4 inches long, and seem to be pendulous. The bracts, by their union, form bidentate cups, which, on the lower part of the spike, and frequently throughout, are 6-flowered, (three flowers on each side.) This seems to be the normal inflorescence of the genus, for in G. elliptica, and often in G. Wrightii, besides the primary flower in each bract, there are two small rudimentary ones.

Another apparently undescribed species of this genus is No. 633 of Wright's Western Texas and New Mexican Collection, (1849.) It is also in the earlier collection of Lindheimer. We have only the male plant. The leaves (including the petioles) are $2\frac{1}{2}$–3 inches in length, oblong and obovate, obtuse, slightly mucronate, nearly glabrous and somewhat shining above, pubescent underneath, smooth and even on the margin; spikes shorter than the leaves, bracts lanceolate or ovate, flowers on short pedicels. Lindheimer and Wright seem to be the only botanists who have collected it. We propose for it the name of G. Lindheimeri.

PLATANACEÆ.

PLATANUS RACEMOSA, *Nutt. in Audubon's Birds t.* 362, *and North Amer. Sylv.* 1 *p.* 47, *t.* 15. P. Mexicana, *Moric. Pl. Nov. ou rar. d'Amer. t.* 26. P. Californica, *Benth. Bot. Sulph. p.* 54, *and Pl. Hartw. p.* 336. Arroyos and plains, near San Gabriel; March 23, (in flower, with

balls of ripe fruit of the preceding year.) This species resembles P. orientalis much more than P. occidentalis.

BETULACEÆ.

Alnus viridis, *DC. Fl. Franç.* 3 *p.* 304? Cajon Pass and Creek, California. The specimens are in very young leaf, with old female aments of the past season. The latter are oblong-ovate, and the fruit is narrowly winged. The leaves are glutinous, acute at the base, and doubly serrate. There are needed specimens in a more mature state in order to be certain of the species.

MYRICACEÆ.

Myrica Californica, *Cham. & Schlecht. in Linnæa* 6, *p.* 535; *Hook. Fl. Bor.-Am.* 2, *p.* 260; *Hook. & Arn. Bot. Beech. p.* 390. Near San Francisco; April 3, (only the male plant); near Monterey, *Mr. Rich*, (in fruit.) Hooker and Arnott are inclined to refer the plant to M. Xalapensis, *H. B. K.*

CUPULIFERÆ.

Castanea chrysophylla, *Dougl. in Hook. Fl. Bor.-Amer.* 2 *p.* 159; *Hook. Lond. Jour. Bot.* 1843, *t.* 16. Gravelly hills near Oakland, California. The plants found by Dr. Bigelow were only from 2–3 feet high, and yet they bore fruit. In Oregon, where it abounds on the Columbia, it is a large tree, sometimes growing 70 feet high. Dr. Parry and Mr. Rich found it at Monterey. It is a beautiful species, and well deserves cultivation. Nuttall, in his North American Sylva, asks whether this tree and Quercus densifolia, *Hook.*, may not be the same. The Castanea had not been figured when the Sylva of Mr. Nuttall was published, nor had he seen specimens of the plant.

Quercus echinacea, *Torr. in Pl. of U. S. Expl. Exped.* (*ined.*): foliis perennantibus lanceolato-oblongis integerrimis vel serrato-dentatis, junioribus subtus cinereo-tomentosis demum glabratis; amentis masculis elongatis densifloris; fructibus sessilibus; cupula hemispherica, squamis filiformibus densis patulis vel reflexis apice plerumque uncinatis; glande brevi ovata. Tokeloma Creek, California; April 17; fruit of the preceding season was collected on the ground. This fine oak was first discovered by Mr. Brackenridge, on the upper waters of the Sacramento Creek, while attached to the United States Exploring Expedition. It was found also by Dr. Parry, botanist of the Mexican Boundary Survey, while under command of Major Emory. We have also received specimens of it from Mr. Burke, and the acorns from Dr. Andrews. It is a near ally of Q. densiflora, *Hook. & Arn.*, which is also a native of California, but is easily distinguished from that species by the remarkable scales of the cup. The leaves are exceedingly variable, for although they are usually more or less lanceolate-oblong, sometimes they are obovate. They are commonly obtuse, but occasionally quite acute, even on the same tree. In the specimens collected by Dr. Bigelow and by Mr. Burke, the leaves are 4–5 inches long, and sharply toothed, as in the chestnut. In those obtained by Mr. Brackenridge they are perfectly entire, except a few of them which are obscurely repand-dentate. The male aments are in clusters, about 4 inches long and about 3 lines in diameter; at their base are a few female flowers. The acorns are 2 or 3 together; the cup is an inch in diameter and thickly covered with rigid subulate or filiform scales, which are at length reflexed or recurved. The acorns are short and thick, about three-fourths of an inch long, obtuse, with a short abrupt point, and of a light-brown color. In the mountains this oak attains the height of 25 or 30 feet, with a trunk six inches in diameter.

Quercus crassipocula, *Torr. in Williamson's Rep. cum tab.* Cajon Pass, Sierra Nevada. The specimens are not in fruit. According to Dr. Bigelow's notes, this species, in favorable situations, becomes a tree 40 feet high, but in poor soils it is a mere bush. In the former the leaves are toothed; in the dwarf plants they are entire.

Quercus densiflora, *Hook. & Arn. Bot. Beech. p.* 391; *Hook. Ic.* 4. *t.* 380; *Nutt. Sylv.* 1. *p.* 11. *t.* 5. Hill-sides on the Yuba, near Downieville, California. There are no acorns, and only old decayed cups of the preceding season, which show the characters very imperfectly. We are not certain but our specimens may belong to a form of the preceding species.

Quercus Emoryi, *Torr. in Emory's Rep.* 1 *p. t.* 9. San Francisco Mountain, and Aztec Pass, New Mexico. A species of Phoradendron frequently grows on this oak.

Quercus agrifolia, *Née. in Ann. Sc. Nat.* 3, *p.* 271; *Hook. Ic.* 3, *t.* 377; *Nutt. Sylv.* 1 *p.* 5, *t.* 2. Corte Madera, and Laguna of Santa Rosa Creek, California; April, May; with male catkins and old acorns. This is a dwarf species in most situations; often loaded with fruit when only 2 or 3 feet high. Sometimes, however, it becomes a tree 40–50 feet high, with a trunk of a foot or more in diameter. It varies greatly in the size, form, and dentures of the leaves, as well as in the size and shape of the acorns. Q. oxyadenia, *Torr. in Sitgreaves' Rep. t.* 17, is this species with the acorns fully developed.

Quercus tinctoria, *Bartram. Trav. p.* 37; *Michx. f. Sylv.* 1, *t.* 24, var. *Californica:* sinubus folii angustioribus, fructibus majoribus, cupula squamis triangulari-ovatis acutioribus. Hill-sides, Napa Valley. This is a common tree in California. It occurs throughout the valley of the Sacramento, and as far south as San Diego. We have not been able to point out characters sufficient to distinguish it specifically from the Q. tinctoria of the Atlantic States, and yet it is probably a distinct species. The qualities of the bark we had no means of determining. It presents some diversity in the size and lobes of the leaf; but the acorns vary more than in the eastern oak. They are generally larger, and the glands are sometimes more than two-thirds immersed in the cup, with the upper scales elongated; but more commonly the cup is much more shallow and the scales more nearly uniform in size. The largest acorns are an inch and a quarter long.

Quercus Garryana, *Hook. Fl. Bor.–Amer.* 2, *p.* 159; *Hook. & Arn. Bot. Beech. p.* 391; *Nutt. Sylv.* 1, *p.* 1, *t.* 1. Santa Rosa Creek, California. Dr. Bigelow found it growing only about 30 feet high; but in Oregon Mr. Nuttall saw trees of this species 90–100 feet in height, with a diameter of from 3 to 6 feet. It belongs to the section of the genus that includes the White Oak.

Quercus Hindsii, *Benth. Bot. Sulph. p.* 55; *Torr. Bot. of Calif. & Oregon, U. S. Expl. Exped. cum icon.* (ined.) Q. longiglanda, *Torr. in Frémont's Geogr. Mem. of Calif.* Plains near Marysville, Feather River, California. Common in the valley of the Sacramento. Dr. Parry found it as far south as Monterey. It is a tall tree with a trunk 3 feet in diameter, and is remarkable for the usually great length of its acorns. These are sometimes even two inches long, and either tapering to a point, or rather obtuse at the summit. Rarely they are somewhat curved. On some trees they are ovate. The cup is tuberculate with the thickened scales.

SALICACEÆ.

Salix Hindsiana, *Benth. Pl. Hartw. p.* 336, *No.* 1956. Swamps and river banks, Mark West's Creek; April 30, (male;) also valleys and ravines near Butte Mountains, Marysville, California; May 25, (in fruit.) Branches very slender, pale-brown, dull. Leaves about an inch and a half long and 2–3 lines wide, thinly pubescent, at first hoary, but when mature pale-green on both sides, very acute at each end. Aments appearing with the leaves, pedunculate, terminating the short lateral branchlets, about an inch long; the male often 2–3 together. Filaments hairy below the middle. Capsules sessile, pubescent, abruptly narrowed to a long beak; style short, but distinct; stigmas with 2 linear lobes. This species is allied to S. exigua. *Nutt. Sylv. I, p.* 75, but the leaves are narrower, perfectly entire, and not silky; the fertile aments shorter, etc. It also resembles No. 1873, Wright, but that has glabrous fruit, bright reddish-brown branchlets, paler leaves, etc.

Salix lasiandra, *Benth. l. c. No.* 1954. Near Bolinas Bay, California; April, in fruit. The

fertile aments only were collected by Dr. Bigelow, while Mr. Bentham describes only the male flowers. There can be little doubt that our plant is the same as his. The fertile aments appear after the leaves are nearly unfolded, and are produced at the extremity of short lateral branches. They are cylindrical, and about two inches long. The capsules are smooth and distinctly pedicellate. Style short, but evident. Stigmas 2-lobed. Leaves $2\frac{1}{2}$ inches long and 6–8 lines wide, distinctly serrulate. There are in Dr. Bigelow's collection more advanced specimens of what appears to be only S. lasiandra. The leaves are fertile, aments are larger, but in other respects there is little difference.

Salix Bigelovii (sp. nov.): foliis obovatis vel cuneato-oblongis obtusissimis integerrimis subtus griseo-pubescentibus supra glabratis nitidulis; amentis (fœmineis) brevi pedunculatis cylindricis elongatis crassis, basi bracteosis; ovariis pedicellatis acutiusculis glabris; stylo elongato; stigmatibus brevibus bilobis; squamis persistentibus villosis. Near San Francisco; April 8, (with immature fruit.) Twigs rather stout, slightly pubescent, dark-brown, and dull. Leaves $1\frac{1}{2}$–2 inches long, and $\frac{1}{2}$ to $\frac{3}{4}$ of an inch broad, on short petioles of a firm but not coriaceous texture. Female catkins nearly two inches long, and more than one-third of an inch in diameter; the peduncle 3–4 lines long; the small leafy bracts at base deciduous. Ovary ovate, supported on a distinct pedicel. Scale about one-fourth the length of the ovary, dark-brown, but the color is concealed by the strong villous pubescence. We know not what else to do with this well characterized willow but to describe it as a new species. It does not appear to have been noticed by any writer on the plants of California and Oregon. The species to which it seems nearest allied is S. planifolia of Hooker. The male flowers were not found. In the collection of Dr. Bigelow was a Salix with female catkins only, which is perhaps the same species as the one just described, but in a younger state. The leaves are silky-pubescent underneath, and slightly pointed.

Two or three other Salices were collected in California, but we are unwilling to decide on them without a more extensive study of all the allied species than we can give them at present.

URTICACEÆ.

Urtica urens, *Linn. Sp.* 2. *p.* 284; *Torr. Fl. N. York.* 2. *p.* 222. Plains near San Gabriel; March 23. Probably introduced from Europe.

HESPEROCNIDE, Nov. Gen.

Flores monoici. *Masc.* Calyx 4-partitum; foliolis æqualibus concavis patentibus. Stamina 4. Ovarii rudimentum. *Fem.* Perigonium oblongo-ovatum, ventricosum; ore minuto bidentato; Ovarium liberum, ovatum, sessile; stigma sessile, pencillatum. Achenium lato, ovatum lenticulari-compressum, calyce membranaceo immutato tectum. Herba annua Californica; pilis urentibus; foliis oppositis ovatis petiolatis dentatis; floribus laxe glomeratis axillaribus, masculi et fœminei in iisdem glomerulis.

Hesperocnide tenella.—Shady rocks, Napa Valley, California; April 25. Stem slender, 3–8 inches high, simple, armed with scattered conspicuous stinging hairs. Leaves broadly ovate, 5–8 lines in diameter; obtuse, serrate-dentate, beset with a few stinging hairs on both sides, and finely ciliate on the margin; petiole about one-third the length of the lamina. Axillary glomerules 15–20-flowered, on short pedicels, mostly female, there being usually only one or two males in a cluster. *Male.* Calyx deeply 4-parted; the segments concave and somewhat saccate at the summit. Stamens nearly twice as long as the calyx. In the centre of the flower is the rudiment of an ovary. Female flowers articulated to a short stalk. Calyx clothed with short uncinate hairs, acute, the orifice minute, bidentate. Ovary loosely but completely enclosed in the calyx. Stigma terminal, nearly sessile, consisting of a tuft of short-jointed hairs. Achenium enclosed in the thin membranaceous calyx, orbicular-ovate, acute, somewhat coriaceous, brownish. Embryo in thin albumen; cotyledons transversely reniform-orbicular; radicle

cylindrical rather shorter than the cotyledons. This little urticaceous plant seems to have been overlooked hitherto. It resembles Bœhmeria, but differs in the inflorescence, pencilliform stigma, and in some other characters. It is still more nearly related to the East Indian genus Pouzolzia, which differs in the "stigma elongatum," and in the fructiferous calyx being "accretum vel 2–4-alatum." The habit is also different: Pouzolzia consisting of perennial shrubs, or under shrubs, with entire leaves.

CONIFERÆ.

Ephedra antisiphilitica, *Berland.; Endl. Syn. Conif. p.* 263. On hills between the Canadian and the Pecos, also along Williams' Fork, (not in flower.)

Taxus brevifolia, *Nutt. Sylv.* 3. *p.* 86, *t.* 108. T. baccata, *Hook. Fl. Bor.-Am.* 2, *p.* 167, (ex parte.) T. Lindleyana, *Murray in Edinb. Phil. Mag. April*, 1855. Mammoth Grove, and hill-sides near Downieville; May. A small tree in California, but in Oregon it sometimes occurs 60 feet high, with a trunk 2 or 3 feet in diameter. We follow Mr. Nuttall in separating the Yew of the Northwest coast from the Taxus baccata of Europe. We have not, however, found the differences pointed out by Mr. Nuttall to be constant. The leaves are not always shorter than in the European species, and in T. Canadensis; nor are they flatter than in the other species, and the male aments, when fully grown, are quite as large as in the Canadian Yew. The chief character in which T. brevifolia differs from T. baccata is the cuspidate leaves of the former. From T. Canadensis it is distinguished by its upright stem.

Torreya Californica, *Torr. in New York Jour. Pharm.* 3, *p.* 49. T. Myristica, *Hook. Bot. Mag. t.* 4780. Tokeloma Creek, near Tomales Bay; April 17, (male flower.) This is the famous *California Nutmeg*. It was first made known to North American botanists by the late Mr. Shelton, who travelled extensively in California. For a description of the plant, we refer to the works here quoted, and to Dr. Bigelow's report on the trees collected on the expedition.*

Sequoia sempervirens, *Endl. Syn. Conif. p.* 198. Taxodium sempervirens, *Lamb. Pin.* (*ed.* 2,) 2, *t.* 64; *Gray, in Sill. Jour.* (2*d ser.*) 18, *p.* 150. Mountains near Oakland. The popular name of this tree in California is Redwood. Dr. Bigelow has given some interesting details respecting it in his special report.

Sequoia gigantea, *Torr. in Sill. Jour. l. c.* Wellingtonia gigantea, *Lindl. Gardner's Chronicle, Dec.* 1853, *p.* 820 *and* 823; *Hook. Bot. Mag. t.* 4777 *and* 4778. A full account of this monarch of the Californian forest will be found in Dr. Bigelow's report, and in the Botanical Magazine, l. c. We have shown that in this tree, as well as in S. sempervirens, the leaves are dimorphous, as they are in many species of Juniperus. We have proved, also, that there is no generic difference between the two trees. The male aments of S. gigantea, which were not known to Lindley and Hooker, prove to be in all respects like those of S. sempervirens. S. gigantea, of Endlicher, (l. c.,) which is founded on Taxodium sempervirens, *Hook. & Arn. Bot. Beech. & Hook. Ic. t.* 379, (not of Humboldt,) has been ascertained by Hooker to be a species of Abies, (A. bracteata, *Bot. Mag. t.* 4640.)

Libocedrus decurrens, *Torr. in Smithson. Contrib.* 6. *p.* 7. *t.* 3. Hills, Duffield's Ranch, Sierra Nevada. Called *White Cedar* in California. It is in Hartweg's California Collection. Dr. Bigelow, in his report, states that the fruit is pendulous, and is incorrectly represented as erect in the plate just quoted; but in most of his own specimens the cones are erect.

Pinus edulis, *Engelm. in Wisliz. Rep. p.* 88; *Torr. in Sitgr. Rep. p.* 173, *t.* 20. Rocky places on the Llano Estacado; also near Hurrah Creek, New Mexico; September 20; with ripe seeds. Near Bill Williams' Mountain; January 5. A tree 40–50 feet high, called *Piñon* by the Mexicans, and *Nut Pine* by American travellers. It is found from 150 miles east of the Rio Grande to the Cajon Pass of the Sierra Nevada. How far it occurs to the southward we have

* Dr. Kellogg, of San Francisco, says that it sometimes attains the height of eighty feet, with a trunk 12–15 inches in diameter.

not been able to ascertain. In Mexico its place seems to be taken by Pinus Ccmbroides, *Zucc.*, which has been found by Dr. Parry on the mountains east of San Diego, in California.

Pinus Lambertiana, *Dougl.; Lamb. Pin. ed.* 2, 1, *p.* 57, *t.* 34; *Endl. Syn. Conif. p.* 150; *Nutt. Sylv.* 3, *p.* 122. *t.* 114. On the castern slope of thc Sierra Nevada. A stately and beautiful tree, not excelled by any in California for its timber. A sweet substance, intermediate between resin and sugar, exudes from it when wounded and partially burned, so that it is generally known in California by the name of *Sugar Pine.*

Pinus Engelmanni. P. brachyptera, *Engelm. in Wisliz. Rep. p.* 89. Hill-sides, Sonora, California. Dr. Bigelow states that this valuable pine makes its first appearance in the mountains between the Pecos and thc Rio Grande, and occurs in large quantities on the mountain ranges quite to the Sierra Nevada. See his report. It is called Yellow Pine and Pitch Pine in some parts of New Mexico. We have changed the specific name, becausc the wing of the seed is not short; Dr. Engelmann himself having ascertained that the specimens from which his description was drawn were not perfect. In our plant the wing is nearly an inch long. The leaves are sometimes nearly six inches in length.

Pinus flexilis, *James, in Long's Exped.* 2, *p.* 27 *&* 35; *Torr. in Ann. Lyc. N. Hist. N. York.* 2, *p.* 249; *Nutt. Sylv.* 3, *p.* 107, *t.* 112. P. Lambertiana, *β. Hook. Fl. Bor.–Amer.* 2, *p.* 162, (ex. Nutt.) Sandia Mountains of New Mexico, "12,000 feet above the level of the sea," and on the San Francisco Mountain, in the western part of the same Territory. It is called *Rocky Mountain White Pine.* The ordinary height of the tree is from 40–50 feet, but Dr. Bigelow saw trunks of it that were more than 100 feet high. The seeds are edible like those of P. Cembra, which this species greatly resembles.

Pinus insignis, *Dougl. in Loud. Arb.* 4, *p.* 2265, *t.* 2170–2172. Mountains near Oakland; also on the south Yuba and on the Coast mountains, California. The cones, when fully grown, are about six inches long. They arc usually gibbous and a little curved; the points of the scales much more developed on the gibbous side. The ordinary height of the tree is from 30–40 feet. This may be the same as the imperfectly described P. Californica, *Lois.*

Pinus Sabiniana, *Dougl. in Lamb. Pin.* (*ed.* 2,) 2, *p.* 146, *t.* 80; *Loud. Arb.* 4, *p.* 2246, *f.* 2138–40, 2142 *&* 2143; *Nutt. Sylv.* 3, *p.* 110, *t.* 103. Duffield's Ranch, etc., at the base of the Sierra Nevada. One of the species called *White Pine* in California. It is remarkable for its very large, heavy cones, the scales of which are produced into a long stout incurved point. See Dr. Bigelow's Report.

Pinus contorta, *Dougl. in Loud. Encl. of Trees, p.* 975, *f.* 9148 *&* 915; *Endl. Syn. Conif. p.* 163. Near Sonora, California. Leaves about 2½ inches long. Cones scarcely 2 inches in length, ovate when closed, but nearly globose when expanded. Its range extends northward to Cape Disappointment.

Abies Douglasii, *Lindl. in Penny Cyclop.* 1, *p.* 32; *Loud. Arb.* 4, *p.* 2319, *f.* 2230; *Nutt. Sylv.* 3, *p.* 129, *t.* 115; *Hook. Fl. Bor.–Amer.* 2, *p.* 162, *t.* 183. From the Sandia Mountains, between the Pecos and Rio Grande, to the coast range of California, on most of the higher mountains. It extends also north to Oregon. Its common name is *Douglas' Spruce.* See Dr. Bigelow's Report.

Abies balsamea, *Mill.?* Pinus balsamea, *Linn.?* Sandia and San Francisco Mountains; also on the Sierra Nevada. We name this tree on the authority of Dr. Bigelow, who says (in his report) that it is identical with the eastern species; but the leaves are considerably longer. No good cones came with the specimens.

Juniperus tetragona, *Schlecht. in Linnœa*, 13, *p.* 495? *Torr. in Sitgreaves' Rep. p.* 173, var. osteosperma, near Bill Williams' Mountain, and on hills fifty miles west of the Colorado of California. This is the smooth-barked Juniperus of Sitgreaves' Report that was supposed might be J. tetragona, *Schlecht.* The short description given of that species by Schlechtendahl leaves us in doubt as to its identity with ours. Thc berries (not quite ripe) are said to be 3–4 lines in diameter, while in our plant they are nearly half an inch. Neither are the fructiferous

branchlets nodding as in that species. Indians are said to use the berries as food. Travellers call this and the following species *Sweet-berried Cedar*. The seeds are as large as a small pea, and the shell is very thick and hard. The branchlets are about a line and a half in diameter. Leaves nearly as broad as long, very closely appressed, (there are no acicular ones in any of our specimens), obtuse, or sometimes rather acute, convex and marked with a depressed gland.

Juniperus pachyphlæa (n. sp.): arborea; foliis omnibus squamiformibus ovatis incrassato-gibbis acutiusculis, dorso glandula elliptica impressa; ramulis obtuse quadrangulatis, fructiferis erectis galbulos globosos minute tuberculatos trispermos brevioribus. Juniperus No. 1, *Torr. in Sitgreaves' Report, p.* 173. On the Zuñi Mountains, Western New Mexico. This is the thick-barked Juniperus of Captain Sitgreaves. It seems to be undescribed, and is distinguished from the preceding species by the character of the bark, and by the berries (which are also very large and sweet) being 3-seeded. From the gland of each leaf a little drop of turpentine exudes. It is possible this may be J. Mexicana, *Schlecht.*, which has berries half an inch in diameter; but in that species the leaves are acuminate, and the berries conspicuously tuberculate, especially at the apex.

Juniperus occidentalis, *Hook. Fl. Bor.–Amer.* 2, *p.* 166. J. Andina, *Nutt. Sylv.* 3, *p.* 95, *t.* 110. Common on the mountains of New Mexico, in various places along the route as far as the Zuñi mountains. The glands are very obscure in the young leaves, but are plainly to be seen in the older ones. The berries are larger and the branchlets much stouter than in J. Virginiana.

Juniperus Virginiana, *Linn. Spec. p.* 1471; *Michx. Sylv.* 2, *p.* 353, *t.* 155. Near Zuñi, Western New Mexico. Resembles the eastern plant, except that the leaves are all scale-like, and the berries are a little larger.

LEMNACEÆ.

Lemna trisulca, *Linn. Spec.* 1, *p.* 1376; *Kunth, Enum.* 3, *p.* 5. Stagnant waters, near San Francisco; mixed with Azolla Caroliniana; also on San Gabriel creek, California. We have never seen North American specimens of this species in flower or fruit.

Lemna minor, *Linn. l. c.; Kunth, l. c.* On the surface of running water; Williams' Fork of the Colorado of California; not in flower.

TYPHACEÆ.

Typha latifolia, *Linn.* Wet places, near Shawneetown, on the Canadian; August; in fruit.

NAIADACEÆ.

Potamogeton hybridus, *Michx. Fl.* 1, *p.* 101. In tributaries of the Canadian River; August; with mature fruit. Easily distinguished by its cristale spiral fruit.

Potamogeton pectinatus, *Linn.; Torr. Fl. N. York*, 2, *p.* 257. With the preceding. Nutlets obovate; the pericarp very thick, with a small lunate cavity.

JUNCAGINEÆ.

Triglochin maritimum, *Linn.; Torr. Fl. N. York*, 2, *p.* 261; *Kunth, Enum.* 3, *p.* 145. Low places in reach of the tide; San Francisco and Corte Madera, April. The fruit, in some of the species, agrees very well with Nuttall's T. elatum, which we fear is not distinct from this species.

ALISMACEÆ.

Damasonium Californicum, *Torr. in Benth. Pl. Hartw. p.* 341:* foliis oblongis seu lanceolatis basi cordatis obtusisve 3–5-nerviis; petals apice incisis; scapis adscententibus; verti-

* We much regret not having received the portion of Bentham's Plantæ Hartwegianæ that contains most of the Endogens.

cillis 6–9-floris ; staminibus 6 ; carpellis 8–10 uniovulatis basi gibbosis abrupte longirostratis. (Tab. XXI. In water, near Ione Valley, California ; May, (in flower and fruit.) Tuber subglobose. Leaves all radical, on elongated petioles ; the lamina 2–3 inches long, and often nearly an inch wide. On young plants the leaves are much smaller, and sometimes not more than 2–4 lines wide. Scapes 12–18 inches high, usually several from one root ; whorls (3–4) distant ; the longer pedicels 1–2 inches in length. Flowers nearly twice as large as in A. Plantago, white. Sepals oblong, obtuse. Stamens shorter than the sepals ; anthers oblong ; filaments subulate from a somewhat dilated base. Ovaries usually 8–9, connected at the base, with a tapering straight style ; each with a solitary ascending anatropous ovule arising from near the base of the cell. Carpels 4–5 lines long, much compressed, abruptly narrowed to a long rigid beak, always one-seeded. This species greatly resembles Damasonium stellatum, *Dalech.* of Europe, but that differs in the entire petals, and in the carpels being almost uniformly six, with the beak gradually narrowed from a broad base. It is a little remarkable to find a representative of the genus or subgenus Damasonium in the Western Hemisphere.

Echinodorus rostratus, *Engelm. in Gray, Man. Bot. ed.* 2, *p.* 439. Alisma rostrata ; *Nutt. in Trans. Amer. Phil. Soc.* (*n. ser.*) 5, *p.* 159. On Mohave creek, California. The seeds of this plant are collected by the Mohave Indians, and used as food. The species is widely diffused. We have it from Key West, Florida, (*Mr. Blodgett*) ; Georgia, (*Dr. Leavenworth*) ; St. Louis, (*Dr. Engelmann*) ; and Texas, (*Drummond*, Coll. 2, No. 432) ; the last a form with narrower leaves, which are not cordate at the base.

Sagittaria simplex, *Pursh, Fl.* 2, *p.* 397 ; *Engelm. in Gray, Man. Bot. ed.* 2, *p.* 439. In water, near the Shawnee villages, on the Canadian River. August. Plant larger than usual ; the blade of the leaves being 5–6 inches long, an inch or more in breadth, and the scape a foot high. Flowers not much larger than in Alisma Plantago.

JUNCACEÆ.

Luzula campestris, *DC.* L. campestris, var. *J. E. Meyer, in Linnæa*, 22, *p.* 407. Near San Francisco, April. Stem 1½–2 feet long. Leaves 3–4 lines wide. Flowers in sessile clusters, forming a compact ovate head. L. comosa of E. Meyer, if we may judge from specimens of Scouler and others referred to that species by Hooker and by Meyer himself, is hardly to be distinguished from L. campestris.

Juncus bufonius, *Linn. Sp. p.* 466 ; *Torr. Fl. N. York*, 2, *p.* 329. Damp places, Los Angeles, etc., California ; May. Wholly like the eastern plant.

Juncus xiphioides, *C. A. Mey. in Reliq. Hœnk.* 2, *p.* 143, *ex Kunth, Enum.* 3, *p.* 331 ; *Hook. & Arn. Bot. Beech. p.* 161. Low grounds, Napa Valley, California, April.

IRIDACEÆ.

Sisyrinchium Bermudiana, *Linn. Sp.* 2, *p.* 954 ; *Torr. Fl. N. York*, 2, *p.* 291, *var.* 1 & 2. Plains, near San Gabriel, California ; March 23 ; mostly the *var.* mucronatum, and with flowers larger than in the eastern plant.

Sisyrinchium lineatum (*Torr. in Emory's Rep. Mex. Bound. ined.*) : scapo late alato erecto simplici basi foliato ; foliis linearibus gramineis ; spatha triflora valde inæquali, folio exteriore flores longe superante ; perianthio luteo lato-campanulato, phyllis obtusis, exterioribus 7-nerviis, interioribus 5-nerviis ; filamentis brevibus glabris ; capsula ovato-pyriforme. Punta de los Reyes, California ; April 18. This species was first detected by Dr. Parry, who found it near San Diego. The flowers are one-third larger than in S. Bermudiana. Another yellow-flowered Sisyrinchium occurs in New Mexico.

Iris longipetala, *Herb. in Hook. & Arn. Bot. Beech. p.* 395. Grass Valley, and near San Francisco ; May 19. Flowers as large as in I. versicolor.

Iris Douglasiana, *Herb. l. c.* Hill-sides, Grass Valley, California; May 19. The tube of the perianth is longer than in our original Douglasian specimens of this plant.

Var.? major: floribus majoribus; pedicellis elongatis (fere unc. longis). Corte Madera, California; April 10.

Iris Missouriensis, *Nutt. Jour. Acad. Phil.* 7, *p.* 58? Sandia Mountains, New Mexico; October. In fruit only. Leaves rather rigid, 4–5 lines wide. Scape 1–2-flowered. Capsules 1–1¼ inch long, obtusely triangled, abruptly contracted at the base; statutes slightly prominent. Seeds obovate, somewhat compressed, reddish brown. Rhizoma thick and creeping, clothed with strong brownish lanceolate scales.

Iris macrosiphon (sp. nov.): pumila; subcaulescens; rhizomate gracili; foliis angustis erectis; caule bifloro; perianthii imberbis tubo prælongo exserto; petalis apice denticulatis; ovario attenuato breviter pedunculato. Hill-sides, etc., Corte Madera, California; April 10. Leaves less than one-third of an inch wide. Stem (exclusive of the flower) 2–3 inches high, the bracts somewhat unequal. Flowers as large as in I. versicolor, bright purple. Tube of the perianth 2½ to 3½ inches long, very slender. Exterior sepals broadly obovate; the interior shorter.

MELANTHACEÆ.

Prosartes Hookeri: foliis sinu profundo cordatis caulem amplectentibus; umbellis 3–4-floris; perianthio basi obtuso, phyllis lanceolatis obtusiusculis; antheris linearibus glabris; stigmate fere integerrimo. Uvularia lanuginosa β. major, *Hook. Fl. Bor.-Am.* 2, *p.* 174. Mountains, near Oakland, California; April 4. Very near P. lanuginosa of the Atlantic States, but differs in the strongly cordate and clasping leaves, more numerous-flowered umbels, and in the form of the sepals.

Prosartes trachyandra (sp. nov.): foliis oblongo-ovatis basi rotundatis seu vix subcordatis arcte sessilibus, inferioribus amplexicaulibus; umbellis 2–3-floris; perianthio basi subacuto, phyllis rhomboideo-lanceolatis; antheris oblongo-linearibus hirtellis; stigmate integerrimo. Hill-sides, Duffield's Ranch, Sierra Nevada; May 10. This species is easily distinguished from the preceding by its scarcely cordate leaves, broader attenuate sepals, and especially by its hispid anthers. The stem is about two feet high, and dichotomously branched. The flowers are as large as in Uvularia perfoliata, and of a greenish white color. At the base of each sepal is a distinct nectariferous pit.

Veratrum viride, *Ait. Kew. ed.* 1, 3, *p.* 422; *Torr. Fl. New York*, 1, *p.* 317. Swamps, near the South Yuba, California; May, (with unexpanded flowers); and marshes, near San Gabriel, (leaves only.)

Anticlea Nuttallii, Amianthium Nuttalii, *Gray, Melanth. Revis. in Ann. Lyc. N, York*, 4, *p.* 123. Amiantanthus Nuttallii, *Kunth, Enum.* 4, *p.* 181. River banks, Mokelumne Hill, and Sonora, California; May, (in fruit.) This is the *Poison* or *Death Camass* of the Northwest Indians. The root is a bulb the size of a musket ball, and is covered with a blackish skin, but is white within. We find the sepals to vary in form, from very obtuse and emarginate to acute or acuminate. The gland is a small, roundish, discolored spot, without a very distinct margin.

Anticlea Fremonti: foliis lato-linearibus planis, racemo composito interdum simplici; sepalis ovatis brevi unguiculatis acutiusculis 5–7-nerviis, glandula superne dentata, dentibus cum basis nervos incrassatos confluentibus. Mountains near Oakland, April 4, (in flower.) Also found by Mr. Rich near Monterey; and by Colonel Frémont at Santa Cruz, (flowering in February,) and on the Uinta River, Utah; June, (in fruit.) It is No. 2009 of Hartweg's Californian collection. We have specimens of it collected in California by Mr. Douglas, so that it is probably Zygadenus chloranthus, *Hook. & Arn. Bot. Beech.* (excl. syn.) Bulb tunicated, about as large as a pigeon's egg. The stem is from a few inches to 4 feet high, simple or paniculately branched above, the branches terminating in simple racemes. Flowers hermaphrodite, three-

fourths of an inch in diameter, the pedicels 1–2 inches long. Bracts linear-lanceolate, about half the length of the pedicels. Sepals greenish-white, narrowed into a short somewhat callous claw, from which spring 5–7 (rarely more) strong nerves. The gland is obscure, occupying the whole breadth of the base of the sepal, toothed on the upper edge, the teeth running into the thickened bases of the nerves. Stamens shorter than the sepals. Anthers roundish-kidney-form. Capsule about an inch long, almost as broad near the summit as at the base. Seeds broad and shining, compressed, variously indented, and angled. We have thrown this and the preceding species into the genus Anticlea of Kunth, as they are excluded from Amianthium by having a gland on the sepals. The character of Anticlea being drawn from A. Sibirica and A. glauca will require to be slightly modified to receive the species we here refer to it. Zigadenus will retain Z. glaberrimus and other species with a creeping rhizoma. Z. elegans of Pursh is pretty certainly Anticlea glauca.

SCOLIOPUS,* Nov. Gen.

Flores hermaphrodite. Perianthium petaloideum 6-phyllum, patens, deciduum; foliola subæquilonga; 3 exteriora oblongo-lanceolata, multiervia; 3 interiora, angusto-linearia. Stamina 3, perianthii exterioris foliolis opposita; filamenta subulata; antheræ oblongæ, extrorsæ. Ovarium liberum, sessile, triquetrum, uniloculare; placentis 3, parietalibus. Stylus brevis, trigonus, trifidus; lobis lineari-subulatis, apice intus stigmatosis. Ovula plurima, biserialia, adscendentia, anatropa. Capsula (immatura) oblonga, subalato-triquetra, polysperma. Semina compressa, raphe valida percursa. Embryo haud visus. Herba Californica, glabra; caule spithameo e rhizomate brevi erecto vaginato apice diphyllo; foliis ovalibus 7–9-nerviis membranaceis basi vaginantibus umbellam sessilem amplectentibus: pedicellis unifloris prælongis nudis flexuosis, in fructu tortuosis.

Scoliopus Bigelovii. (Tab. XXII.) Tamul Pass, Marin county, not far from San Francisco, on the opposite side of the bay; past flowering early in April. We have specimens in full flower, collected by Mr. Samuels, but in what part of California we have not been informed. The leaves are 6–8 inches long and 2–4 inches broad, varying from acute to rather obtuse. They are marked with from 5 to 7 primary nerves, which are narrowly winged on the under surface, and above they are sprinkled with minute purple dots. The pedicels are from 7 to 12 or more in number, 3–8 inches long, about the size of a packthread, and more or less tortuous. Dr. Bigelow informs us that they spread out and lie upon the ground after flowering. The exterior leaflets of the perianth (or rather sepals) are about 7 lines long, apparently of a dull purplish-color, and widely spreading. The inner leaflets, or petals, are scarcely half a line wide, and about the length of the sepals. Stamens one-third the length of the sepals, and inserted at their base: anthers more than a line long, manifestly extrorse. Ovary tapering upward; style 3-cleft nearly to the base; the segments subulate, recurved. Capsule (immature) about two-thirds of an inch long, acute at the base, apparently loculicidal. Ripe seeds not known. This remarkable new genus is placed at the end of Melanthaceæ chiefly on account of its extrorse anthers, notwithstanding its one-celled fruit and parietal placentation. The somewhat dichlamydeous flowers are suggestive of Trilliaceæ, but the extrorse anthers, as well as other characters, would seem to forbid its being placed in that group. In Melanthaceæ, however, Tofieldia and Pleea have introrse anthers. If it were not for the loculicidal placentation, (so rare a character in Endogens,) we might regard Scoliopus as intermediate between Melanthaceæ and Trilliaceæ.

LILIACEÆ.

Erythronium grandiflorum, *Pursh, Fl.* 1, *p.* 231; *Lindl. in Bot. Reg. t.* 1786; *Kunth, Enum.* 4, *p.* 218. Hills near Forest City, California; May 21. All the specimens from this locality are one-flowered. The stigma is manifestly 3-cleft, with the segments recurved.

* From σκολιος and πους, in allusion to the tortuous pedicels.

Erythronium grandiflorum, var. multiflorum: foliis immaculatis; floribus 1–6 racemosis; sepalis lanceolatis acuminatis a basi fere reflexis; stigmate clavato-capitato. Hill-sides, Downieville, California; May 21. Some of the scapes, which had apparently been stung by an insect, were 10–15 flowered. Sepals bright lilac, yellow at the base on the inside.

Fritillaria Kamtschatcensis, *Fisch. in Hook. Fl. Bor.-Am.* 2, *p.* 181, *t.* 193, *A.* F. biflora, *Lindl. Bot. Reg. fol.* 1663; *Hook. & Arn. Bot. Beech. p.* 397. Laguna of Santa Rosa Creek, California; May, (in fruit.) The specimens are mostly single flowered; stem about 14 inches high, mostly naked above. Lowest leaves verticillate in threes, the others few and scattered. Capsule subglobose, obtusely 6-angled. A variety? from hill-sides, Sonoma, has the stem 2-flowered, and the (immature) capsule acutely 6-angled.

Fritillaria mutica, *Lind. l. c.; Hook. & Arn. l. c.* San Francisco, April 30, (in flower;) mountains near Oakland, California, April 4, (also in flower;) hill-sides, Martinez, April 23, (in fruit, but immature.) The capsule of this species is strongly 6-winged, as in F. lanceolata, *Pursh*, from this species is hardly distinct.

Fritillaria liliacea, *Lindl. l. c.; Hook. & Arn. l. c.* Hill-sides near Nevada; May 21, (flower.)

Fritillaria parviflora (sp. nov.): foliis anguste lanceolato-linearibus, infimis verticillatis, superioribus sparsis; floribus sparsis longe racemosis nutantibus; bracteis pedicellos recurvos multo longioribus; perianthio basi subangusto; stylo usque ad medium fere trifido; capsula hexaptera. Hill-sides near Murphy's, California; May 16, (in flower.) This species is near F. lanceolata, but it has more numerous (5–20) and much smaller flowers, (scarcely three-fourths of an inch long.) Sepals with an obscure nectariferous groove, greenish-purple, with darker striæ, but not spotted.

Cyclobothra alba, *Benth. in Hort. Trans.* (*n. ser.*) 1, *p.* 413, *t.* 14, *f.* 3; *Lindl. in Bot. Reg. t.* 1661; *Hook. & Arn. Bot. Beech. p.* 399. Grass Valley, May 19, (in fl. & fr.;) hill-sides and ravines, Sonoma; May.

Cyclobothra pulchella, *Benth. l. c. t.* 14, *f.* 1; *Lindl. in Bot. Reg. t.* 1662; *Hook. & Arn. l. c.* Hill-sides, Napa Valley; April 27.

Cyclobothra elegans, *Lindl. l. c.; Kunth, Enum.* 4, *p.* 229. Calochortus elegans, *Pursh, Fl.* 1, *p.* 240; *Dougl. in Hort. Trans.* 7, *p.* 278, *t.* 9, *f.* 13. Hills near Punta de los Reys; April 17. The Calochortus Tolmæi, *Hook. & Arn. l. c.* (in a note) is perhaps not distinct from this species. The inflorescence appears racemose from the unequal forking of the stems, each division bearing from two to four flowers. It seems to be the plant described by Pursh, who remarks that the petals are "covered with long down." There are other forms of this species in Dr. Bigelow's collection: one from the mountains of Oakland, (April 4,) in which the petals are sparsely bearded not half way from the base; and another (a dwarf state) from the Sierra Nevada (May 11) with the petals glabrous except an adnate fringed scale at the base.

Calochortus venustus, *Benth. l. c. t.* 15, *f.* 3; *Hook. & Arn. l. c.; Lindl. in Bot. Reg. t.* 1669. Hill-sides, Knight's Ferry, Stanislaus River, California; May 7, (fl.)

Calochortus luteus, *Dougl. Mss.; Lindl. in Bot. Reg. t.* 1567? In the same place as the preceding. This seems to be intermediate between *C. luteus* and *C. uniflorus*. With the former it agrees in its usually 3-flowered stem, and with the latter in its petals. It may perhaps be a variety of C. elegans.

Calochortus nitidus, *Dougl. in Hort. Trans.* 7, *p.* 277, *t.* 9, *f. A.?* Cyclobothra nitida, *Kunth, Enum.* 4, *p.* 230. Grass Valley, May 19; and hill-sides, Sonora, California, May 9. A dwarf plant, scarcely a span high. Stem 2–4-flowered. Pod drooping, ovate, not winged. Petals orange-yellow, copiously bearded.

Lilium Canadense, *Linn.*, var. puberulum: caule pedunculisque minute pubescentibus; foliis lato-lanceolatis margine nervisque puberulis; floribus paucis (2–7) longe pedunculatis; sepalis a medio valde revolutis intus purpureo-maculatis. Grows in all the region between Grass Valley and

Downieville, California. Colonel Frémont found it on Antelope Creek, one of the tributaries of the Upper Sacramento, and it is No. 2004 of Hartweg's California collection. If the character given above prove constant, this fine lily must be considered a distinct species from L. Canadense.

Yucca aloifolia, *Linn. Spec. p.* 457; *Kunth, Enum.* 4, *p.* 270? Near a mountain arroyo, Williams' River. "Plant 15 feet high." The specimens are with leaves only. Also found at Cajon Pass, Sierra Nevada, in March, with ripe capsules of the preceding season. The same plant, or one very much resembling it, was found by Mr. Wright in New Mexico, and is his No. 1909. The flowers are very large and white.

Yucca Draconis, *Linn. l. c.; Kunth, l. c.* Var. arborescens: foliis lineari-lanceolatis rigidis, margine serrulato-scabris. Sandy and gravelly plains west of the Colorado, California. Dr. Bigelow states that this species attains the height of 30 feet, with a diameter of 18 or 24 inches. He found "whole forests" of this tree on the Mohave creek. The leaves are flat, about $3\frac{1}{2}$ inches long, and from $\frac{1}{3}$ to $\frac{1}{2}$ an inch wide, thick, convex below, flat or concave above, pointed with a strong spike, the broad flat base about half as long as the upper rigid and narrower portion. For want of more complete specimens we cannot be certain of the species.

Yucca angustifolia, *Pursh, Fl.* 1, *p.* 227; *Nutt. Gen.* 1, *p.* 218. Plains of Northern New Mexico. Leaves only: these are 12–15 inches long, and scarcely more than one-fourth of an inch wide, tapering upward, and ending in a strong sharp spine, thick and rigid, filamentous on the margin, along which is a narrow white line.

Dr. Bigelow collected in New Mexico (near Hurrah creek) specimens of a Yucca which seems to be undescribed. The leaves are a foot or more in length, and nearly an inch wide, very thick, entire, abruptly pointed with a short blunt spine, and furnished on the margin (especially towards the base and summit) with coarse tortuous fibres, tapering a little towards the base, and then dilated into a short sheathing base, which is of a brownish-red color. Flowers not seen. Fruit racemose, drooping, oval, as large as a hen's egg, pointed with the thick persistent style. It is of a soft fleshy consistence, and has a sweet taste. Endocarp thin and almost membranaceous, 3-celled, each cell partially divided into two others. Seeds piled horizontally in the cells, somewhat semi-circular, with thick edges, flat, black, wrinkled. Embryo straight, cylindrical, nearly the length of the seed; the albumen fleshy and somewhat indurated, a transverse section (parallel with the flat surfaces) appearing ruminated. The fleshy fruit, on account of the large quantity of grape sugar it contains, can be dried without decomposition, so as to have about the same consistence as a dry fig.

Still another species was found in rocky places near Pecan creek, a tributary of the Canadian. The leaves are a foot long, and three-fourths of an inch wide, flat and rather thin; the margin thin, sparingly furnished with very fine threads. No flowers were obtained. The fruit is in an elongated raceme. The pods are about two inches long, and more than an inch in diameter, erect and pedicellate; the mesocarp thin and somewhat fleshy, when dry a little papillose; cells divided by an accessory septum into 2 locelli. Seeds flat, smooth, and thin, black; the embryo two-thirds the length of the albumen. We need more complete specimens in order to determine whether the species is described.

Camassia esculenta, *Lindl. Bot. Mag. t.* 1486; *Kunth, Enum.* 4, *p.* 347. Phalangium Quamash, *Pursh, Fl.* 1, *p.* 226. Marshes, Punta de los Reyes, California; April 17. The Scilla esculenta, *Gawl. in Bot. Mag. t.* 1574, (Phalangium esculentum, *Nutt.*) is certainly a congener of this plant, and not a Scilla. In our specimens of the C. esculenta, *Lindl.*, we do not find the five upper sepals ascending, and the lowest one deflexed; but it is difficult to decide on such characters in dried specimens. In other respects the Northwest Coast species is so near the eastern one that they can be distinguished only by the considerably larger flowers, usually broader leaves, and more numerous ovules of the former. We find from 16–to 18 ovules in each cell of the ovary of C. esculenta, while in the other, which may be called C. Fraseri, the cells are only 8-ovuled. The genus Scilla has the sepals one-nerved, somewhat campanulate-con-

nivent or urceolate, and the filaments a little adnate to the base of the sepals. In Camassia the sepals are 3–5-nerved, and the filaments are free to the very base of the sepals.

Scilla (Camassia) angusta, *Engelm. & Gray in Bot. Journ. Nat. Hist.* 5, *p.* 29, is only a slender form of C. Fraseri.

Chlorogalum pomeridianum, *Kunth, Enum.* 4, *p.* 682. C. divaricatum, *Kunth, l. c.?* Anthericum pomeridianum, *Gawl. Bot. Reg. t.* 561. Phalangium pomeridianum, *D. Don. in Sweet's Flow. Gard. (ser.* 2,) *t.* 381. Hill-sides, Stanislaus River, California; May 8. This is the celebrated Amole or Soap Plant of California. It has an extensive range from north to south in that country, being found from the valley of the Upper Sacramento to Monterey. The bulb is ovate-conical, and varies from less than an inch to 4 inches in diameter. It is (especially when old) clothed with the black fibrous vestiges of the outer scales. The inner scales are mucilaginous when bruised, and are used by the Mexicans as a substitute for soap. There is but one Californian species of this genus that has come under our observation. The native country of the original species, which has long been cultivated in Europe, is not recorded in the books, but the plant is generally supposed to have been brought from Mexico. It is very doubtful whether C. divaricatum be a distinct species. The characters of the two as given by Gawler and Lindley seem blended in our plant. We suspect that Don was mistaken in describing the cells of the ovary as several-ovuled. In our specimens they have but two ovules, as described by Kunth.

Allium cernuum, *Roth; Bot. Mag. t.* 1324; *Kunth, Enum.* 4, *p.* 435. Mountains and rocky places, near Laguna Blanca, New Mexico; September.

Allium acuminatum *Hook. Fl. Bor.-Am.* 2, *p.* 185, *t.* 196; *Hook. & Arn. Bot. Beech. p.* 349. Hill-sides, Sonora, and near Marysville, California; May 3–25. A showy species, with deep rose-colored flowers.

Allium falcifolium, *Hook. & Arn. l. c.* Benicia, and on the Yuba River, California; April—May. About a span high. Also a much larger form, with the bracts as long as the flowers. Tamal Pass, April.

Allium tribracteatum (sp. nov.): humilis; foliis radicalibus plerumque 2 angusto-linearibus scapum 2–4-pollicarem multo superantibus; umbella multiflora; spatha e bracteis 3 ovatis; perianthio basi acuto, sepalis lanceolatis acutis; filamentis subulatis basi parum dilatatis sepala subæquantibus; capsula late obovato-trigastrica, lobis rotundatis, loculis dispermis. Hill-sides, Duffield's Ranch, Sierra Nevada, May 10. Bulb ovate, three-fourths of an inch long. Leaves mostly 2, about three lines wide, recurved. Scape 3–4 inches long. Umbell 15–20 flowered. Spathe of 3 ovate bracts. Pedicels scarcely longer than the flower. Sepals pale rose-color, with a purple midrib, about 4 lines long, not acuminate. Filaments inserted near the base of the sepals. Style filiform; stigma minute, obscurely 3-lobed. Capsule narrow at the base, but not stipitate; the cells rarely perfecting more than one seed. We cannot refer this Allium to any described species. It is remarkable for its dwarf habit, 3-leaved spatha, and the sepals marked with a strong purple central nerve.

Allium amplectens (sp. nov.): scapo flexuoso spithamaeo superne bifoliato; foliis filiformibus; umbella pauci-(3–6-) flora; spatha e bracteis 2 orbiculatis concavis subacuminatis flores amplectentibus; sepalis oblongis obtusiusculis; filamentis e basi lata submonadelpha subulatis; capsula trigastrica apice depressa, loculis dispermis. Hill-sides, Sonoma, California; May 3. Bulb large for the size of the plant. Scape 6 inches high, more or less flexous. Leaves scarcely a line wide, overtopping the scape. Easily distinguished by the small few-flowered umbel, which is almost enclosed in the concave purple bracts.

Hesperoscordium? maritimum (sp. nov.): sepalis a basi fere distinctis; filamentis e basi vix dilatata subulatis. Sea shore, Punta de los Reyes, California; April 17. Bulb the size of a small pea. Leaves all radical, narrowly linear. Scape 3–6 inches long, shorter than the leaves. Umbel 10–12-flowered; the lower pedicels an inch in length, the others much shorter.

Bracteal leaves 4–6, subulate-linear, connate at the base. Flowers apparently white. Sepals oblong, rather acute, and minutely sacculate at the lip, slightly united at the base, membranaceous on the margin, the midrib broad and thick. Stamens 6, equal; filaments inserted a little above the base of the sepals, not connected; anthers oblong, 2-celled, inserted near the middle of the back. Ovary ovate, obtuse, 3-celled, with 10 anatropous ovules in each cell, in a double series. Style filiform, erect, slightly clavate upward; stigma minutely 3-cleft. This little plant seems to have been hitherto overlooked. It differs from Hesperoscordium in the sepals being distinct nearly to the base, and in the slender filaments.

Dichelostemma congesta, *Kunth, Enum.* 4, *p.* 470. Brodiæa congesta, *Smith, in Linn. Trans.* 10, *p.* 3, *t.* 1; *Hook. Fl. Bor.-Amer.* 2, *p.* 186. Cocomungo, March 8, and hill-sides, Martinez, California; April 20, (in fruit.) Our numerous specimens of this plant collected in various parts of California have the flowers all hexandrous, (as, indeed, they are shown in the early figure of Salisbury); nor do we find any hypogynous scales, except a slight callosity at the base of each adnate filament.

Brodiæa grandiflora, *Smith, l. c.; Kunth, Enum.* 4, *p.* 471. Var.? brachypoda: umbella multiflora, pedicellis floribus multo brevioribus; staminibus sterilibus lato-lanceolatis integris. Plains of the Sacramento, May 26, (in flower and fruit.) The same plant was collected also by Colonel Frémont on Utah Lake, and by Dr. Stillman on the Sacramento.

Var. macropoda: scapo foliis multo breviore; umbella pauci-(3–6-) flora, pedicellis flores multoties excedentibus; staminibus sterilibus lato-linearibus emarginatis. Swamps, Santa Rosa creek, and Laguna, California; May 1. Tuber the size of a marble. Scape only 2–3 inches high. The longer pedicels 3–4 inches in length. Flowers bright purple, about three-fourths of an inch long.

STROPHOLIRION.* Nov. Gen.

Perianthium corollaceum campanulato-infundibuliforme, 6-fidum; tubo subventricoso 6-sacculato; segmentis æqualibus ovatis obtusis uninerviis suberectis. Stamina fertilia 3, segmentis interioribus perianthii opposita; filamenta tubo adnata, summo apice appendicibus 2 linearibus emarginatis, antheram linearem bilocularem utrinque fissam, adæquantibus, aucta: sterilia linearia, uninervia, emarginata, glanduloso-ciliata fertilibus æquilonga. Ovarium oblongum, basi attenuatum (haud stipitatum), triloculare: ovula in loculis 4, biseriata anatropa, adscendentia: stylus ovario longior, triangularis, superne subfistulosus: stigma 3-lobum, lobis brevibus obtusis fimbriato-papillosis. Capsula ovata, sessilis, trilocularis, loculicida; loculis sæpius abortu monospermis. Semina ovata, nigra, longitudinaliter striata. (Embryo ignotus.) Herba Californica, glabra, foliis lato-linearibus breviusculis et scapo gracili nudo 2–4-pedali volubuli e cormo globoso exortis; umbella terminali multiflora densa, bracteis concavis spathaceis coloratis involucrata; pedicellis cum flore articulatis; floribus saturate roseis.

Strophoirion Californicum. (Tab. XXIII.) In rocky places, Knight's Ferry, Stanislaus River, May, (in flower and fruit); also at Sonora, Mokelumne Hill; Valley of the Sacramento, *Colonel Frémont*, *Mr. Rich*, and *Dr. Stillman*. It is No. 1992 of Hartweg's Californian collection. A remarkable plant, of which we have had specimens for many years. It seems to be common in the Valley of the Sacramento. The tall stem, which is not larger than a crow-quill, and often more than 4 feet (Dr. Kellogg, of San Francisco, found it even 12 feet) in length, twines around other plants. In Dr. Bigelow's specimens they were on Calliprora. Not unfrequently several stalks are twined together. The umbel is about 20-flowered, and much resembles that of some species of Allium, so that at first we took the plant for one of that genus. It most resembles Dichelostemma, but differs in having only three perfect stamens, and these furnished with appendages, while the abortive stamens are simple or undivided. There are also other characters, besides the habit, in which it differs from that genus.

* From στρεφω, to turn or twist, (in allusion to the twining stalk,) and λειριον, lily.

Seubertia laxa, *Kunth, Enum.* 4, *p.* 475. Triteleia laxa, *Benth. in Hort. Trans.* (*n. ser.*) 1, *p.* 413, *t.* 15, *f.* 2; *Hook. & Arn. in Bot. Beech. p.* 401. Plains of Benicia, California, April 14—23. It is No. 1998 of Hartweg's Californian collection. A showy plant, resembling Brodiæa grandiflora, but with larger hexandrous flowers, and the ovary elevated on a very long stipe.

Calliprora lutea, *Lindl. in Bot. Reg. t.* 1590; *Hook. in Bot. Mag. t.* 3588; *Kunth, Enum.* 4, *p.* 476. Hills, near Sonora, and Grass Valley, California; May 19, (in flower and fruit.)

ODONTOSTOMUM,* Nov. Gen.

Perianthium hypocraterimorphum, marcescens; segmentis 6 æqualibus patentissimis, 3 exterioribus 5-nerviis, interioribus 7-nerviis; tubo cylindrico segmentis æquilongo, ima basi ovario accreto, demum paullo supra basim transversim rupto deciduo. Stamina fertilia 6, conformia: filamenta lato-subulata, plana, discreta, fauci calycis inserta, cum appendicibus seu filamentis sterilibus totidem alternantibus: antheræ subrotundæ, biloculares, fissuris 2 transversis apice dehiscentes. Ovarium globosum, 3-loculare, loculis biovulatis: stylus gracilis, filiformis: stigma minutum. Ovula collateralia, e basi loculi adscendentia, anatropa. Capsula globoso-triloba, trilocularis loculicida; loculis dispermis. Herba Californica, bulbifera? caulescens, glabra; caule e basi parce dichotomo; foliis radicalibus lato-linearibus, caulinis angustioribus, summis in bracteas transeuntibus; floribus albidis racemosis vel paniculatis; pedicellis solitariis 1–2-bracteolatis haud articulatis.

Odontostomum Hartwegii. Wet places, Ione Valley, California; May 18. Valley of the Sacramento, *Dr. Stillman.* It is No. 2008 of Hartweg's Californian collection. Plant about two feet high. Radical leaves 3–6 lines wide, flat. Bracts lanceolate-subulate, about as long as the filiform pedicels, which are furnished with a subulate bracteole a little below the flower. Raceme 3–8 inches long. Flowers half an inch in diameter; the segments elliptical-oblong, rather obtuse, as long as the tube, at length reflexed. Seeds all empty shells in our specimens. This genus is allied to Pasithea and Zephyra; but these differ in the want of sterile filaments; the more numerous ovules; in the dehiscence of the anthers, and in several other characters. We received it several years ago from our friend Dr. Stillman, of New York, but it seems to have been first collected by Mr. Hartweg.

Clintonia Andrewsiana (n. sp.): umbellis 2–4 in parte superiori scapi subremotis, terminali multiflora, ceteris paucifloris; floribus erectiusculis; perianthiis subcampanulatis; ovarii loculis 8–10-ovulatis. Hill-sides, Tamul Pass; also along the *Redwood* (Sequoia sempervirens) ravines of Costa County, east of Pablo Bay, California. The only specimens of this interesting plant found by Dr. Bigelow have the flowers scarcely expanded; but we fortunately, while this report was in press, received it in a more advanced state from Dr. Andrews, lately of California, and to this gentleman, who has assiduously examined the botany of that State, we dedicate the species. No ticket accompanied his specimens, but they were probably collected not far from San Francisco. The root consists of numerous thick descending fibres, which proceed from a small fleshy tuber. The leaves grow from the summit of a slender, erect, or curved caudex, which is 5 or 6 inches long, and clothed below with sheathing scales. They are from 7 to 11 inches long, and 3–4 inches broad, narrowed and sheathing at the base, with a short abrupt acumination, glabrous and green on both sides, but the margin sparingly ciliate with slender deciduous hairs. The nerves are very numerous, and run from the base to the apex. The scape is about twice as long as the leaves, terete, and naked, except a lanceolate or linear foliaccous bract at the base of the lower umbel, or at some distance below it. Terminal umbel 10–20-flowered; the lateral ones 2–4-flowered and sessile. Pedicels about the length of the flower, somewhat elongated in fruit. Sepals 6, about 8 lines long, 5–7-nerved, oblong, obtuse, apparently greenish-yellow. Stamens 6; filaments subulate, flat; anthers

* From *ὀδους*, tooth, and *στομα*, mouth; in allusion to the tooth-like sterile filaments at the orifice of the flower.

oblong-linear somewhat versatile, the cells opening inward near the margin, the membranous connective produced externally nearly to the base of the cells. Ovary oblong-fusiform, tapering into a cylindrical thickish tubular style; stigma truncate, slightly 2-lipped, and perforate at the extremity. Ovules 8–10 in each cell, in a double series, obliquely ascending. Fruit (immature) subglobose, about one third of an inch in diameter. Seeds 6–8 in each cell, oblong.

This species is remarkable for bearing one or more few-flowered umbels besides the primary or terminal one; otherwise it has a general resemblance to C. umbellata. As in that species, the flowers are erect and numerous, but they are considerably larger and subcampanulate. It differs, too, in the numerous ovules.

Smilacina racemosa, *Desf. in Ann. du Mus. Paris*, 9, *p.* 51; *Torr. Fl. N. York* 2, *p.* 298, *t.* 130. Near Bolinas Bay; April 19; and mountains near Oakland, California; April 4. It seems to differ in no essential character from the eastern plant.

Smilacina stellata, *Desf. l. c.; Torr. l. c.* Asteranthemum vulgare, *Kunth, Enum.* 5, *p.* 152. Mountains near Oakland, California; April 4.

Smilacina bifolia, *Desf. l. c.; Torr. l. c.* Maianthemum bifolium, *DC. in Redouté, Lil.* 4, *t.* 216, *f.* 2; *Kunth, Enum.* 5, *p.* 147. Marshes, Punta de los Reys, California; April 17. The plant of Oregon and California differs from the S. bifolia of the Atlantic States in the leaves being more deeply cordate, or almost auriculate, and in the longer petioles. It is much more like the European plant. The leaves are more commonly three than two.

AMARYLLIDACEÆ.

Dasylirion Bigelovii (sp. nov.): foliis longissimis (3–4-ped.) lineari-ensiformibus in apicem acutissimum sensim attenuatis integerrimis, margine lævibus; panicula ampla densa; fructibus lato-trialatis trilocularibus sæpissime monospermis, loculis 2 inanibus. Mountain sides, Williams' River. In fruit, February 10, (doubtless from the flowers of the preceding season.) "Scape about 3 feet high." We have not been furnished with Dr. Bigelow's notes on this plant, but it is evidently an undescribed species, of which flowering specimens are desirable. Kunth described the genus as having a one-celled ovary, while in three of his six species it is said to be three-celled!

At Plaza Larga, in Eastern New Mexico, Dr. Bigelow found another Dasylirion, of which the leaves only are in the collection. These are nearly a yard long, and 3–4 lines wide at the base, gradually tapering upward, entire and nearly smooth on the margin, convex on the lower surface and concave above, except towards the apex, where they are somewhat triangular. It is allied to D. Texanum, but seems to be an undescribed species.

SMILACEÆ.

Trillium sessile, *Linn. Spec. p.* 484; *Kunth, Enum.* 5, *p.* 123. *β.* giganteum, *Hook. & Arn. Bot. Beech. p.* 402. Mountains near Oakland; April 4. The petals are more than three inches long, and of a dark purple color.

γ. angustipetalum, *Torr. in Emory's Rep. Mex. Bound. Comm.* (*ined.*): foliis basi subito contractes; petalis lanceolato-linearibus acutis, sepala purpurea fere duplo superantibus. Wet ravines, Washington Mammoth Grove; May 15.

δ. chloropetalum: petalis viridulis obovato ellipticis, obtusiusculis, sepala duplo superantibus, Redwoods; April 12.

Trillium ovatum, *Pursh, Fl.* 1, *p.* 249; *Hook. Fl. Bor.-Am.* 2, *p.* 180; *Kunth, l. c.* Redwoods; April 12.

Smilax Pseudo-China, *Linn.?* Banks of rivulets, Shawnee Villages, near the Canadian River; August, in fruit. Leaves orbicular-ovate, with a short abrupt acumination, often somewhat cordate, glabrous on both sides, paler underneath. Peduncles usually twice the length of the petioles. Berries black, mostly one-seeded.

ORCHIDACEÆ.

SPIRANTHES DECIPIENS, *Hook. Fl. Bor.-Am.* 2, *p.* 203, *t.* 204. Low places, Mammoth Grove, Calaveras County; May, (in fruit of the prceding season.)

SPIRANTHES CERNUA, *Rich.; Torr. Fl. N. York*, 2, *p.* 283, *t.* 129. Prairies on the Canadian River, and valley of the Upper Rio Grande; September, October.

CORALLORHIZA STRIATA, *Lindl. Gen. & Sp. Orchid. p.* 534. Corte Madera, California; April. Scape 12–15 inches high, 20–30-flowered. Flowers larger than in any other North American species. Lip not spotted. C. Macræi, *Gray*, is a ncarly allied species. (Tab. XXV.)

APLECTRUM HYEMALE, *Nutt. Gen.* 2, *p.* 197; *Torr. l. c. p.* 270, *t.* 127. Shawnee Villages, on the Canadian; August.

CYPERACEÆ.

CYPERUS INFLEXUS, *Muhl.; Torr. Cyp. p.* 273. Low places near Albuquerque, and on the Upper Canadian River. Bentham (*Plant. Hartw.*) refers this plant to C. aristatus of Rottboel, which, indeed, it much resembles, as was remarked long ago in the work just quoted; but we are not yet satisfied that the two species should be united.

CYPERUS MICHAUXIANUS, *Schultes; Torr. l. c. p.* 259. Wet sandy places, headwaters of the Canadian River. This species is found as far west as the Great Colorado.

CYPERUS DIANDRUS, *Torr. Cyp. p.* 264. Wet sandy places near Albuquerque, New Mexico.

CYPERUS REPENS, *Ell. Sk.* 1, *p.* 69; *Torr. l. c.* C. phymatodes, *Muhl.* Grows with the last.

CYPERUS LUTESCENS, *Torr. & Hook. in Torr. Cyp. p.* 433. Alluvions of Pecan Creek; August; and prairies near the Upper Canadian. The heads arc inclined to be compound, and contain morc numerous spikelets than Drummond's specimens, from which the original description of this species was taken. The spikelets, too, become brownish when old, so that the name is not wholly appropriate.

FUIRENA SQUARROSA, var. ARISTULATA, *Torr. Cyp. p.* 291. Borders of running water, Upper Cross Timbers of the Canadian River. Our specimens agrce exactly with those collected by Dr. James in Long's Expedition.

HEMICARPHA SUBSQUARROSA, *Nees. Cyp. in Endl. & Mart. Fl. Bras. p.* 61, *t.* 4, *f.* 1; *Torr Fl. N. York*, 2, *p.* 362. Isolepis subsquarrosa, *Torr. Cyp. p.* 348. Scirpus subsquarrosus, *Muhl.* Wet sandy places near Albuquerque, New Mexico.

ELEOCHARIS ACICULARIS, *R. Brown; Torr. Cyp. in Ann. Lyc. New York*, 3, *p.* 308. Var.? culmo crasso brevi, spica ovato-lanccolata valde compressa acuta 6–7-flora. Wet places near San Francisco; April 8; not mature. Differs from the ordinary form of the plant in its stout culm, (which is 2–3 inches high,) and much compressed dark chestnut-colored scales. There are 3 stamens and a 3-cleft style, which has a distinct tubercle at its base; but no bristles were found.

ELEOCHARIS PYGMÆA, *Torr. l. c.* (*excl. syn. Vahl.*) Cocomungo, California; April 18. Although the specimens are rather too young for certain determination, they agree very well with the plant of the Eastern States. Kunth (*Enum.* 2, *p.* 158) retains Scirpus pusillus of Vahl in the genus Scirpus, although he seems to have examined the original specimens of that plant. He also refers to it the S. pusillus of Willdenow's herbarium; but quotes it again under his own Eleocharis reclinata! Vahl's plant was from New England, and seems to be only one of the forms of E. acicularis. Willdenow's is probably not different, as he received most of his North American plants from Muhlenberg, who refers S. pusillus, *Vahl*, to S. trichodes, which is undoubtedly Eleocharis acicularis.

ELEOCHARIS PYGMÆA, var. ANACHÆTA. Moist places near Albuquerque, New Mexico. This variety was noticed in the botany of Nicollet's Report, p. 163. We have it also from the Red River, Louisiana, where it was collected by Dr. Hale.

ELEOCHARIS CAPITATA, *R. Br.; Torr. Cyp. p.* 305. With the last. We have this species from Texas, collected by Drummond, and also by Dr. Leavenworth.

ISOLEPIS CARINATA, *Hook. & Arn. in Torr. Cyp. l. c. p.* 349. Wet places, Laguna of Santa Rosa Creek, California; May 1. This agrees well with the eastern plant, except that the achenium is more minutely roughened, and the spikes are sometimes in pairs.

ISOLEPIS LEPTOCAULIS (sp. nov.): culmo sulcato angulato setaceo elongato basi 1–3-phyllo; spica ovata 10–12-flora; involucro monophyllo spicam superante; squamis ovatis obtusis, infimo bracteiformi acuminato; stylo trifido. Cocomungo, California; March 18. The spike is apparently lateral, and indeed the one-leaved involucre (which is 5–6 times as long as the spike) may be regarded as a continuation of the culm. The species resembles I. carinata, but differs in being much more slender and taller, with smaller heads, and the scales are not acuminate. There were no mature achenia on the specimens.

SCIRPUS TRIQUETER, *Linn.?* Near San Francisco? The specimens are too young for satisfactory determination.

SCIRPUS LACUSTRIS, *Linn.; Torr. Cyp. p.* 321. Overflowed places, Comanche Plains, and near San Domingo, New Mexico.

SCIRPUS MARITIMUS, var. MACROSTACHYOS, *Michx.; Torr. l. c. p.* 323. Sandy alluvions of the Upper Canadian River; probably in saline soils.

SCIRPUS SYLVATICUS, *Linn.; Torr. l. c. p.* 323. Wet ravines, Upper Cross Timbers of the Canadian River.

ERIOPHORUM GRACILE, *Koch; Hook. Fl. Bor.–Amer.* 2, *p.* 232; *Gray, Bot. U. States, p.* 529. E. angustifolium, *Torr. Cyp. p.* 339, not of Roth. Swamps near Sonoma, California; May 3, (with mature achenia.) The peduncles are mostly erect, and much shorter than the spikes.

FIMBRISTYLIS SPADICEA, *Vahl; Torr. Cyp. p.* 346. Borders of streams, Upper Cross Timbers of the Canadian River.

CAREX* SITCHENSIS, *Prescott, in Hook. Fl. Bor.–Am.* 2, *p.* 220, *t.* 221. Marshes at the head of Tomales Bay, and near San Francisco, California; April.

CAREX DECIDUA, *Boott, in Linn. Trans.* 20, *p.* 119. Mountains near Oakland, Los Angeles, Duffield's Ranch, Sierra Nevada, and other parts of California; April, May.

CAREX LACINIATA, *Boott, in Benth. Plant. Hartweg ined.* Swamps on Mark West's Creek, Bolinas Bay, etc., California; April. This is the same as Hartweg's No. 2022, and Coulter's 806. It is likewise (in part) 1241 *Herb. U. S. Expl. Exped.* from the Sacramento. It is very near C. Jamesii, *Torr.*, quæ foliis glaucis, auriculis pallidis discretis elongatis, perigyniis nervosis glabris bracteis brevioribus, squamis non ciliatis differt.

CAREX XALAPENSIS, *Kunth, Enum.* 2, *p.* 380. Low swampy places, Mark West's Creek, and Napa, California; April 25–30.

CAREX DEWEYANA, *Schwein.; Torr. & Schwein. Mon. Car. in Ann. Lyc. N. York*, 1, *p.* 316. Shady hill-sides, Napa Valley, California; May 5. The Oregon specimens and these have 6–8 approximate spiculæ.

CAREX FESTIVA, *Dew. in Sill. Jour.* 29, *p.* 351. Spica oblonga; in uno specimine spicula infima subremota. Punta de los Reyes, California; April 18.

CAREX GEYERI, *Boott, in Linn. Trans.* 20, *p.* 118. Flosculis fœminiis 2–3, squamis inferioribus foliaceis. Hill-sides, Duffield's Ranch, Sierra Nevada, California; May 10–12. This is like Dr. Parry's specimens collected in California. Kunze's figure, t. 47, has a solitary female flower.

CAREX HOODII, *Boott, in Hook. Fl. Bor.–Am.* 2, *p.* 211, *t.* 211. Mark West's Creek, California; May 1.

CAREX LAGOPODIOIDES, *Schk. Car. t. Yyy. f.* 177; *Torr. & Schw. l. c. p.* 313. Mark West's Creek, California; May 1.

* The Carices of this collection were determined by our valued friend Dr. Boott, whose names and remarks are given as they were received from him.

Carex vesicaria, *Linn.; Schk. Car. t. Ss. f.* 106. With the last; April 30. One of the specimens is *var. major, Boott, l. c.*

Carex siccata, *Dewey, in Sill. Journ.* 10, *p.* 278, *t. F. f.* 18; *and* 14, *p.* 353. C. pallida, *Meyer.* With the last species; April 30.

Carex stellulata, *Good. in Linn. Trans.* 2, *p.* 144; *Schk. Car. t.* 3, *f.* 14. Swamps, Santa Rosa, California; May 3.

Carex propinqua, *Nees, et Mey. in Kunth, Enum.* 2, *p.* 396. Swamps, Mark West's Creek, California; April 30. No. 1622 of Coulter's California collection.

Carex Cherokeensis, *Schw.; Torr. & Schw. Car. in Ann. Lyc. N. York,* 1, *p.* 369, *t.* 25, *f.* 1. Swamps, Santa Rosa Creek, California; May 1. We can find no character that will distinguish this from the eastern plant. The specimens are young. The ovate abbreviate spikes and short bracts give it a peculiar aspect. It might be considered a *var. minor.* C. Cherokeensis, like all its allies, is very variable; from solitary to geminate and ternate spikes, (my C. Christiana, *in Bost. Jour. Nat. Hist.*) Bigelow's specimens, if mature, would closely resemble the original figure of C. Cherokeensis, *Torr. & Schwein. Monogr. of N. Amer. Car. in Ann. Lyc. N. York,* 1, *t.* 25, *f.* 1.

GRAMINEÆ.

Alopecurus geniculatus, *Linn. Spec. p.* 89; *Kunth, Enum.* 1, *p.* 24. Low places, Napa Valley, California; April 26. A. borealis, *Trin.*, seems to be only a form of this variable species.

Phalaris arundinacea, *Linn. Spec. p.* 80; *Torr. Fl. N. York,* 2, *p.* 418. P. Californica, *Hook. & Arn. Bot. Beech. p.* 161. Bolinas Bay, April 19, and Napa Valley, California; April 26.

Hierochloa borealis, *Rœm. & Schult. Syst.* 2, *p.* 513; *Hook. Fl. Bor.-Amer.* 2, *p.* 234. Red-woods, California; April 12. Male flowers with a very short awn, or sometimes scarcely mucronate.

Stipa Neesiana, *Trin. & Rupr. Stip. p.* 27; *Steud. Syn. Glum. p.* 124. S. avenacea, *Hook. & Arn. Bot. Beech. p.* 403, *non Linn.* Hill-sides, Sonoma, May 3, and Benicia, California; April 23. It is No. 2028 of Hartweg's collection. It differs from S. avenacea of the eastern States in its much larger flowers, the almost villous lower palea, the hairiness of the awn below the articulation, and in the pubescent leaves.

Agrostis microphylla, *Steud. Syn. Pl. Glum. p.* 164? Mark West's creek, California, May 1. This species was founded on a grass collected by Douglas in "North America;" doubtless in California, though it is not taken up by Hooker and Arnott in the Botany of Beechey's Voyage. It is Agraulus brevifolius, *Nees, Mss.* Our plant differs somewhat from the grass described by Steudel. It is rather stout than "slender," and is nearly two feet high. The leaves are flat, about two lines wide, and, as well as the sheaths, are quite rough to the feel. Panicle about three inches long, contracted; the branches fasciculate and somewhat conglomerate. The flowers are of a purplish tinge. Glumes nearly equal, lanceolate, tapering to a long slender point, the lower one rough on the keel, otherwise glabrous; both of them without lateral nerves. Lower palea less than half the length of the glumes, truncate, with four short teeth at the summit, furnished a little below the middle of the back with a nearly straight slender awn, which is nearly twice the length of the valve. Upper palea wanting, or appearing as a very minute rudiment. Stamens 3. Styles plumose.

Calamagrostis gigantea, *Nutt. in Trans. Amer. Phil. Soc.* (*n. ser.*) 5, *p.* 143. Prairies and ravines, along the Canadian River. Glumes somewhat coriaceous, one-nerved, the superior nearly 2–3 times the length of the paleæ, hairs at the base of the latter more than half the length of the valves. Caryopsis oblong, obtuse at each end, large for the size of the spikelet.

Sporobolus cryptandrus, *Gray, Man. p.* 542. Vilfa cryptandra, *Torr. Fl. N. York,* 2, 440.

Var.? foliis angustioribus; panicula exserta, axillis nudis; gluma superiore obtusiuscula. Low places, Galisteo, New Mexico; October. Utricle obovate, somewhat coriaceous, closely investing the ripe seed, but easily separated; loose before the seed is mature.

VILFA TRICHOLEPIS (n. sp.): culmo erecto simplici tereti, nodis distantibus, vaginis glabris, ligula truncata; foliis angustis ($\frac{1}{2}$ lin. latis) utrinque glabris, panicula oblonga, ramulis flexuosis; glumis subæqualibus acutiusculis valvulas subæquales pilosas $\frac{1}{4}$ brevioribus. Sandia mountains, New Mexico; October. Culms a foot or 18 inches long, growing in tufts. Branches of the panicle alternate, naked in the axils, when old somewhat open. Pedicels mostly rather longer than the spikelets, which are about a line in length. Glumes smooth and almost hyaline. Paleæ nearly equal, very hairy on the back and margins, particularly on the nerves; the lower palea 3-nerved. This seems to be a genuine Vilfa.

MUHLENBERGIA GRACILLIMA (n. sp.): cæspitosa, glabra; culmo simplici; foliis angustissimis involutis brevissimis (1–1$\frac{1}{2}$ poll.), ligula elongata fissa; panicula diffusa capillari, ramis subsolitariis; pedicellis spicula (1$\frac{1}{2}$ lin.) subduplolongioribus; glumis muticis lanceolatis, paleis vix duplo brevioribus, palea inferiore glabra apice minute bifido setam ipsa æqualem gerente; callo nudo. Llano Estacado, and near the Antelope hills of the Canadian River; September. Culms (including the panicle) about a foot high, densely cæspitose, erect. Leaves mostly in radical tufts, more or less tortuous. Panicle 5–6 inches long, pyramidal; the branches capillary and widely spreading, alternate, or sometimes opposite. Spikelets lanceolate, mostly purplish. Glumes acute. Inferior palea 3-nerved, slightly 2-toothed at the apex, with a straight awn about the length of the valve, between the teeth of which it is inserted. Superior palea not bicarinate, but rounded on the back. Caryopsis very slender and acute, nearly the length of the palea.

GYMNOPOGON RACEMOSUS, *Beauv. Agrost. p.* 41, *t.* 9, *f.* 5. Anthopogon lepturoides, *Nutt. Gen.* 1, *p.* 82. Prairies, on Pecan creek, Indian Territory.

CHLORIS ALBA, *Presl; Kunth, Enum.* 1, *p.* 264. Var. ARISTULATA: aristis valvulæ vix dimidio longioribus. C. alba, *Benth. Bot. Sulph. p.* 56; *Torr. in Emory's Rep. p.* 152. Banks of the Upper Rio Grande; October. This is the same as No. 395 of Drummond's 2d Texan collection. The awns are commonly less than half the length of the valves.

BOUTELOUA ERIOPODA, *Torr. in Emory's Rep. p.* 154, (sub Chondrosium.) Pyramid mountain, near Laguna Colorado, and in deep ravines on the Llano Estacado; September.

BOUTELOUA OLIGOSTACHYA, *Torr.; Gray Man. Bot. ed.* 2, *p.* 553. Atheropogon oligostachyum, *Nutt. Gen.* 1, *p.* 78. Prairies on the Canadian; August.

BOUTELOUA HIRSUTA, *Lagasca Elench. p.* 5. Chondrosium hirtum, *H.B.K.;* Kunth, Enum. 1, p. 276. Atheropogon papillosus, *Engelm.* High sandy prairies, Upper Cross Timbers of the Canadian; September.

PAPPOPHORUM BOREALE, *Ledeb.; Steud. Gram. p.* 200. P. phleoides. *Turcz.* Llano Estacado, in deep ravines. This agrees so well with the authentic specimen of P. phleoides received from Fischer that we can hardly regard it as even a variety. It is not uncommon in New Mexico.

LEPTOCHLOA MUCRONATA, *Kunth, Enum.* 1, *p.* 270. Eleusine mucronata, *Michx. Fl.* 1, *p.* 65. Banks of Boggy creek, Indian Territory; August.

LEPTOCHLOA FASCICULARIS, *Gray, Man. ed.* 2, *p.* 550. L.? polystachya, *Kunth, Enum.* 1, *p.* 270. Diplachne fascicularis, *Torr. Fl. N. York,* 2. *p.* 472. Festuca fasciculatea, *Lam.* Sandy banks of the Canadian River; August.

AIRA ELONGATA, *Hook. Fl. Bor. Bor.-Amer.* 2, *p.* 253, *t.* 138. Plains and hill-sides, Mark West's creek, April 30; Napa Valley, May 5, (a small form.) This is hardly a true Aira. The spikelets are commonly 2-flowered, with a plumose stipitate terminal rudiment. The upper perfect flower is distant from the lower one, on a hairy rachis. Glumes equal, subulate-pointed, obscurely 3-nerved. Paleæ bearded at the base; the inferior one unequally 5-toothed at the summit, awned below the middle; the awn twice the length of the palea, and somewhat

geniculate; upper palea hairy at the tip. Stamen solitary. No. 2030 of Hartweg's Californian collection is the same grass as this.

AVENA FATUA, *Linn. Spec. p.* 118; *Kunth, Enum.* 1, *p.* 302. Hills and plains, Feather River; Benicia, &c. April and May. This is the common wild oat of California. It may have been introduced by the Spaniards; but it is now spread over the whole country, many miles from the coast.

TRICUSPIS MUTICA (n. sp.): cæspitosa, glabra; culmo simplicissimo erecto; foliis convoluto-filiformibus; panicula terminali longe exserta racemosa, ramis brevibus oligostachyis; spiculis teretiusculis 5–8 floris; palea inferiore mutica integra vel bifida, margine dorsoque longe ciliata. Laguna Colorado, New Mexico; September. About a foot high, growing in tufts. Root perennial. Culm rigid terete. Leaves 3–6 inches long. Panicle about 3 inches long, the short appressed bearing 3–5 spikelets. Glumes unequal 1-nerved, rather acute, scarcely half the length of the spikelets. Inferior palea (after flowering) usually more or less deeply notched, otherwise entire; or when old slightly toothed or eroded; the midnerve not at all produced into a mucro, and the lateral submarginal nerves scarcely reaching to the summit; the long white hairs confined to the lower half of the nerves. Superior palea one-third shorter than the inferior, notched at the apex, plumose on the margin. Stamens 3; anthers oblong. Styles short, stigmas plumose, purple. Caryopsis oblong, concave on the inner face, finely striated longitudinally.

TRICUSPIS PULCHELLA. Uralepis pulchella, *Kunth, Enum. p.* 108, *and Suppl. p.* 274. Trichodia pulchella *H. B. K. Nov. Gen.* 1, *t.* 47. Gravelly hills, near Albuquerque, New Mexico; October. A beautiful little grass with densely cæspitose culms and few-flowered panicles, which are crowded among the fasciculate leafy branches. It occurs along the Rio Grande, and southward to Mexico. The root appears to be annual, but Kunth says that it is perennial.

TRICUSPIS PURPUREA, *Gray, Man. Bot. ed.* 2, *p.* 556. Uralepis purpurea and U. aristulata, *Nutt. Gen.* 1, *p.* 62. Wet ravines, Elm creek, Indian Territory; August.

ERAGROSTIS PURSHII, *Schrad.; Gray, Man. ed.* 2, *p.* 564. Poa pectinacea, *Pursh, Fl.* 1, *p.* 81, *non Michx.* Sandy soils on the Rio Grande, near Albuquerque; October.

ERAGROSTIS TENUIS, *Gray, l. c.* Poa tenuis, *Ell. Sk.* 1, *p.* 156. Prairies, and along streams, Upper Cross Timbers of the Canadian; August. E. Frankii, *Mey.*, scarcely differs, except in the smaller number of flowers in the spikelets.

ERAGROSTIS OXYLEPIS, *Torr. in Marcy's Rep. p.* 301, *t.* 19, (sub Poa.) Poa interrupta, *Nutt. in Trans. Amer. Phil. Soc. n. ser.* 5, *p.* 146, *non Roth. nec R. Br.* Sandy ravines, near the Canadian river. Spikelets larger than usual, and some of them 30–40 flowered.

POA ANNUA, *Linn. Spec. p.* 99; *Kunth, Enum.* 1, *p.* 349. San Francisco, April. A common grass in the settled parts of California, and doubtless introduced from Europe.

POA TRIVIALIS, *Linn. Spec. l. c.; Kunth, l. c.* Mark West's creek, California; April 30. This also must be an introduced grass.

FESTUCA MICROSTACHYS, *Nutt. Pl. Gamb. in Jour. Acad. Phil.* (*n. ser.*) 1, *p.* 187. Hill-sides, Napa Valley, April 26, (an unusully large form); near San Francisco, April 8, (a dwarf state.) This is a polymorphous species. The sheaths of the leaves are often retrorsely pubescent, but not unfrequently smooth. The panicle, in the humbler form, is strict and spikelike; but in more luxuriant specimens several of the lower branches are somewhat elongated, and at length spreading or diverging and secund. In a variety (as we are inclined to regard it) from Mark West's creek the panicle is very open, and the spikelets are all distant and diverging. The paleæ in some of the specimens from Napa Valley are puncticulate-scabrous, and not hairy. No. 2030 of Hartweg's collection is a variety of this species.

FESTUCA TENELLA, *Willd. Sp.* 1, *p.* 419? var. ARISTULATA. Hill-sides, Napa Valley. Very likely this may prove to be a distinct species from F. tenella of the Eastern States.

FESTUCA PRATENSIS, *Huds.; Kunth, Enum.* 1, *p.* 404. Corte Madera and Tomales Bay, April. Introduced?

Festuca scabrella, *Hook. Fl. Bor.-Amer.* 2, *p.* 252, *t.* 233. Hills near Tomales Bay, California; April 19. A tall glaucous grass (2–3-feet high.) Spikelets 5-flowered and a rudiment. Paleæ scabrous.

Brizopyrum Douglasii, *Hook. & Arn. Bot. Beech. p.* 404. Poa Douglasii, *Steud. Enum. Pl. Glum. p.* 261. Sandy sea shore. Punta de los Reyes. April 17.

Melica poæoides, *Nutt. Pl. Gamb. l. c.* Corte Madera, California; April 20. Spikelets 3–4-flowered, the uppermost abortive (male or neuter.) In depauperate specimens the spikelets are often but 2-flowered, with rudiment.

Melica imperfecta, *Trin. Gram. Suppl. in Act. Petrop. p.* 59, *and Icon. Gram. t.* 355; *Hook. & Arn. Bot. Beech. p.* 403, (sphalm. M. imperforata.) M. elpodioides, *Nees in Tayl. Ann. Nat. Hist.* 1 *p.* 282; *Steud. Syn. Pl. Glum. p.* 291. Red-woods, April 12, (spikelets with two perfect flowers and a capitate rudiment; leaves glabrous;) Mark West's creek, California, April 30, (spikelets with a single perfect flower and a capitate rudiment; leaves pubescent.)

Uniola stricta, *Torr. in Ann. Lyc. N. York*, I, *p.* 153, *& in Marcy's Rep. p.* 301 *& 20.* Dry salt marshes, Indian Territory; August.

Sesleria dactyloides, *Nutt. Gen.* I, *p.* 165; *Torr. in Emory's Rep. p.* 154, *t.* 10. Llano Estacado; September. As usual, with male flowers only. We have now examined specimens of this grass collected in very many places, and from an extensive range of country, but have not yet found it in seed, and very rarely with even abortive pistils.

Bromus carinatus, *Hook. & Arn. Bot. Beech. p.* 403. Mark West's creek, April 30. As Hooker & Arnott truly remark, the grass is intermediate between Bromus & Ceratochloa; but it is nearer the former.

Bromus Kalmii, *Gray, Man. Bot. N. States, p.* 600*?* Var. aristulatus; glabrius culus; panicula debile, ramulis elongatis divergentibus, spiculis 6–7-floris; paleis minute pubescentibus, inferiore integro, apice brevissime aristata. Mark West's creek, California. April 30.

Bromus ciliatus, *Linn.*, var. purgans, *Gray, Man. ed.* 2, *p.* 567. B. purgans, *Linn.* Mountain ravines, on the Pecos, New Mexico; October.

Arundo Phragmites, *Linn.* Sandy alluvions of the Canadian river, near the Antelope Hills; September.

Elymus villosus, *Muhl. Gram. p.* 175; *β.* glabriusculus: radice repente; culmo foliisque glabriusculis; vaginis inferioribus pubescentibus; spica erecta, spiculis 2–(raro 3;) floris–glumis lanceolato-subulatis scabriusculis breviaristatis; palea superiore scabra arista ipsa 3-plo longiore. Napa Valley, California; May 6. This grass, though apparently only a variety of E. villosus, is also closely related to E. Europæus.

Hordeum pratense, *Huds.; Kunth, Enum.* 1, *p.* 452. H. secalinum, *Schreb.* H. Chilense, *Brongn.* It is also No. 2025 of Hartweg, and No. 756 of Coulter. Corte Madera, California; April. Differs from our Swedish specimens of H. pratense in the lateral flowers being one-valved and neuter; but in this genus the awns of the neuter flowers are variable.

Sitanion elymoides, *Raf. in Jour. de Phys.* 89, *p.* 103; *Steud. Syn. Pl. Glum. p.* 351. Ægilops Hystrix, *Nutt. Gen.* 1, *p.* 86. Elymus? Sitanion, *Schult. Mant.* 2, *p.* 426. Polyantherix Hystrix, *Nees, in Ann. Nat. Hist.* 1, *p.* 284; *Hook. & Arn. Bot. Beech. p.* 404. Elymus v. nov. gen. *Torr. in Nicollet's Rep. p.* 165. River banks, Mokelumne Hill, California; May 17. We restore the name given by Rafinesque to this grass, because it is the earliest. Our California specimens are nearly two feet high. Indeed, we have never seen the plant of so humble a stature as that described by Mr. Nuttall. It is a widely diffused grass, being found from northern Minnesota to Texas, and west of the Pacific. It is often mistaken for an Elymus.

Lepturus paniculatus, *Nutt. Gen.* 1, *p.* 81. Llano Estacado, and plains near Galisteo, New Mexico; September—October. This species is remarkable for its triangular branching rachis and long very slender spikes. There is but a single one-flowered spikelet at each joint of the rachis, without any trace of a rudimentary flower. Glumes 2, opposite, contrary to the rachis,

very unequal, lanceolate, sharply carinate, each terminating in a bristle as long as itself. Paleæ somewhat coriaceous, linear-lanceolate, almost terete, long as the upper glume; the inferior acute, rough on the keel; superior pubescent on the back, with two approximate nerves, which are produced into teeth at the summit. Stamens 3; anthers linear. Styles long; stigmas plumose on the inside. Caryopsis linear-fusiform.

MONROA. Nov. Gen.

Spæculæ 2–6-flor; flores sessiles distichi hermaphroditi v. terminali tabescente. Glumæ 2, subopositæ mucronatæ, flores multobreviores. Paleæ 2 herbaecæ rigidæ, inferior apice mucronata vel brevissime aristata, ecarinata, æquilatera, lateribus in spiculæ superiores versus basim baribatis, in spicula infima plerumpue glabris. Caryopsis glaberrima, palea superiori obtecta. Gramen annuum, repens, ramosissimum, ramis fasciculatis. Spica capitulæformi sæpius foliorum terminalium subspathæformibus suffultæ. Spiculæ 3, 2–6-floræ.

Monroa squarrosa. Crypsis squarrosa, *Nutt. Gen.* 1, *p.* 49. Hills and ravines, Anton Chico, New Mexico; September. "On the arid plains of the Upper Missouri, near the Grand Detour, it covers, almost exclusively, thousands of acres."—*Nutt.* This grass is very distinct from Crypsis, and belongs, as we think, to the tribe Hordeaceæ. In the notice of Dr. James' plants, collected in Long's 1st expedition, (Ann. Lyc. Nat. Hist. N. York, 2, p. 254,) it was intimated that it was probably a distinct genus. The culm is prostrate, much branched from the base; the branches 3–8 inches long. Leaves 1–2 inches long, flat, 1–2 lines wide, somewhat pungent, scabrous on the margin; those near the summit of the fasciculate branches with broad sheaths, embracing the small sessile heads, which thus appear involucrate. Spikelets mostly 3, closely approximated, usually 3–4-flowered. Glumes sometimes almost unilateral, linear–lanceolate, carinate. Paleæ 2–3 times longer than the glumes, lanceolate, acute; the lower one often bifid or 2-toothed at the summit, with a cusp or very short rigid bristle between the teeth, 3-nerved; the lateral nerves nearly marginal. In the uppermost spikelet, and often in the middle one, these nerves are bearded with long white hairs towards the base; but the flowers of the lowest spikelet are usually quite naked. Superior palea bicarinate, rather obtuse. Stamens 3; anthers linear. Styles long and slender; stigmas plumose. Achenium compressed, very smooth and even, usually covered with the introflexed margin of the superior palea. We dedicate this singular genus to Major Monro, of the East India Company's service, who has made the grasses an especial study.

Triticum (Agropyrum) repens, *Linn.* Prairies, on the Canadian River; August. An awnless glabrous form, with narrow and somewhat involute leaves.

Setaria glauca, *Beauv.; Kunth, Enum. p.* 149. Banks of Little River, Indian Territory; August.

Setaria viridis, *Beauv.; Kunth, l. c. p.* 151. Laguna Colorado, New Mexico; August.

Panicum Crus-Galli, *Linn.* Oplismenus Crus-Galli, *Kunth, l. c.* 1, *p.* 143· With the last; also on the banks of the Pecos, New Mexico. All the specimens from the latter locality belong to the awnless variety.

Panicum virgatum, *Linn.; Kunth l. c. p.* 100; *Torr. Fl. N. Y.* 2, *p.* 425. With the last.

Panicum sanguinale, *Linn.; Torr. l. c. p.* 423. Alluvial banks of the Canadian, and near Galisteo, New Mexico; August—October.

Panicum latifolium, *Linn.; Torr. l. c. p.* 425. With the last.

Panicum obtusum, *H. B. K.? Torr. in Marcy's Rep. p.* 299. Plains, Laguna Colorado, New Mexico; September.

Cenchrus tribuloides, *Linn.; Torr. Fl. New York,* 2, *p.* 931. On the Canadian River, and near Galisteo, New Mexico; October.

Tripsacum dactyloides, *Linn.; Michx. Fl.* 1, *p.* 60. Pecan creek, Indian Territory. T.

cylindricum, *Michx.* l. *c.*, is a Rottbollia, (R. cylindrica,) and seems to be the same as R. campestris, *Nutt.* l. *c. p.* 151.

ANDROPOGON NUTANS, *Linn.* A. avenaceus, *Michx. Fl.* 1, *p.* 60. Sorghum nutans, *Gray, Man. ed.* 2, *p.* 584. With the last.

ANDROPOGON SCOPARIUS, *Michx. l. c.; Torr. Fl. New York*, 2, *p.* 478. With the preceding, and on the Llano Estacado; August--September.

ANDROPOGON FURCATUS, *Linn.* Pecan creek and Llano Estacado; August—September. Pedicels of the sterile spikelets clothed with longer and whiter hairs than in the eastern plant.

ANDROPOGON JAMESII, *Torr. in Marcy's Rep. p.* 302. A. glaucus, *Torr. in Ann. Lyc. New York*, 1, *p.* 152. A. Torreyanus, *Steud. Syn. Pl. Glum. p.* 392. Comanche Plains, Indian Territory; August.

LYCOPODIACEÆ.

SELAGINELLA STRUTHIOLOIDES. Lycopodium struthioloides, *Presl, Rel. Haenk.* 1, *p.* 82, (ex. Hook. & Arn.) L. rupestre, *β. Hook. & Arn. Bot. Beech., p.* 267. Wet rocks, mountains of California and New Mexico; March.

SELAGINELLA RUPESTRIS, *Spring; Brackenridge, Fil. U. S. Expl. Exped. p.* 331. Mountains of New Mexico.

EQUISETACEÆ.

EQUISETUM EBURNEUM, *Schreb.; Braun & Engelm. in Sill. Jour.* 46, *p.* 84. E. fluviatile, *J. E. Smith, Eng. Bot. t.* 2022; *Hook. Fl. Bor.–Amer.* 2, *p.* 269. E. Telmateia, *Ehrh.* Redwoods and mountains near Oakland, California; April. Plant sometimes 3–4 feet high. It is very doubtful whether this species grows on the borders of Lakes Erie and Superior. The station given for it long ago by Dr. Beck, in his Botany of the Northern States, was on my authority, and I was led into the error by the incorrect label attached to a specimen which I received from a correspondent.

EQUISETUM ARVENSE, *Linn.; Pursh, Fl.* 2, *p.* 651; *Eng. Bot. t.* 2020; *Braun & Engelm. l. c. Torr. Fl. N. York*, 2, *p.* 480. In overflowed places, Duffield's Ranch, Sierra Nevada; May 11.

EQUISETUM HYEMALE, *Linn.; Pursh, l. c. Eng. Bot. t.* 914; *Braun & Engelm. l. c.; Torr. Fl. N. York, l. c.* Santa Rosa Creek, California; May 1. We can hardly distinguish several of species allied to E. hyemale, described by Braun & Engelmann, l. c., for they seem to pass into each other by imperceptible gradations.

FILICES.

POLYPODIUM VULGARE *β.* OCCIDENTALL, *Hook. Fl. Bor.–Am.* 2, *p.* 258. P. vulgare, Virginianum, *Bong. Veg. Sitcha, p.* 57. Redwoods, California; April 12. This is nearer P. vulgare of Europe than is the plant of the Atlantic States, which we are now inclined to regard as a distinct species.

POLYPODIUM CALIFORNICUM, *Kaulf. Enum. Fil. p.* 102; *Hook. & Arn. Bot. Beech. p.* 161 & 405; *Hook. Fl. Bor.–Amer.* 2, *p.* 258. Mountains near San Gabriel; April 5. Differs from the preceding in the membranaceous fronds, shorter and rather obtuse pinnæ. The figure in the Icones Filicum of Hooker and Greville (t. 56, P. Scouleri of that work) represents a dwarf state of this species.

POLYPODIUM INTERMEDIUM, *Hook. & Arn. l. c. p.* 405; *Hook. l. c.* Rocky ravines, Cajon Pass; March. This plant greatly resembles P. Californicum, and is chiefly distinguished from it by the oval sori.

ALLOSORUS ANDROMEDÆFOLIUS, *Kaulf. Enum. Fil. p.* 188. Pteris andromedæfolia, *Hook. & Arn. Bot. Beech., p.* 406. Hill-sides, Cajon Pass, California. This seems to be the plant described

by Kaulfuss, although the next species has often been taken for it. Dr. Parry collected it near Monterey. Our specimens more than a foot high. The pinnules vary from 3 to 5-foliolate.

Allosorus mucronatus, *D. C. Eaton, in Sill. Jour.* (2*d ser.*) 22, *p.* 138. Cajon Pass, Sierra Nevada; valley of the Sacramento, *Dr. Stillman;* California, *Douglas.* Our specimens are much larger than the plant described by Mr. Eaton, of which we have duplicates from that promising young botanist. It is often more than a foot high, the pinnæ 10 to 20, and these pinnate, with the pinnules trifoliolate, somewhat verticillate, and crowded. It is much more common than the last species.

Adiantum Chilense, *Kaulf. Enum. p.* 207; *Hook. Fil.* 2, *p.* 43, *t.* 75, *B.* Deep ravines near Los Angeles; also in Napa Valley and near the Redwoods, California; March.

Adiantum pedatum, *Linn.; Torr. Fl. N. York*, 2, *p.* 487; *Brack. l. c.* Redwoods; April. This differs somewhat from the plant of the Atlantic States, in being more slender, with the lobes of the frond broader at the base, and more deeply cut, but it can hardly be considered even as a distinct variety.

Pteris lanuginosa, *Kaulf. l. c.; Hook. & Arn. l. c.* Rocks near San Francisco Mountain, Western New Mexico.

Onychium densum, *Brackenridge, Ferns of the U. S. Expl. Exped.* 1, *p.* 120, *t.* 13. Wet places, Grass Valley, California; May. This neat and rare fern has much the appearance of Allosorus acrostichoides; and Sir William Hooker says it must be removed to that genus or to Pellæa. It is beautifully figured in the work here quoted.

Hypolepis Californica, *Hook. Fil.* 2, *p.* 71, *t.* 88, *A.* Mountains near San Gabriel, also near Marysville, California. Mr. Schott found it in Sonora.

Cheilanthes Fendleri, *Hook. Fil.* 2, *p.* 103, *t.* 107, *B.* On rocks near the mouth of White Cliff Creek, Western New Mexico.

Cheilanthes Bradburii, *Hook. l. c. p.* 97, *t.* 109, *B.* New Mexico, not rare.

Cheilanthes vestita, *Swartz; Hook. l. c. p.* 98, *t.* 108, *B.* On rocks in various parts of New Mexico. Extremely woolly when young.

Notochlæna dealbata, *Kunze, in Sill. Jour.* (2*d ser.*) 6, *p.* 83. Cheilanthes dealbata, *Pursh, Fl.* 2, *p.* 675. Rocky hills, San Domingo, New Mexico. A beautiful and delicate fern, remarkable for the sharply zigzag branches of the rachis, and the white incrustation on the under surface of the frond.

Gymnogramma triangularis, *Kaulf. Enum. p.* 73; *Hook. & Grev. Ic. Fil. t.* 153; *Hook. Fl. Bor.-Am.* 2, *p.* 259. Hills and rocky places, Cajon Creek, and Redwoods. Young fronds sulphur-yellow underneath, (in dry specimens); the old ones brown. This species occurs also in New Mexico.

Woodwardia radicans, *Willd. Sp.* 5, *p.* 418; *Hook. & Arn. Bot. Beech. p.* 162 & 405. W. Chamissonis, *Brack. l. c. p.* 138. Cajon Pass; March; in fine fruit, probably of the preceding season. Mr. Brackenridge considers this to be distinct from W. radicans. Like W. Virginica, it belongs to the genus Doodia of R. Brown, which is now generally regarded as a section of Woodwardia.

Cystopteris fragilis, *Bernh.; Hook. l. c. p.* 260. Aspidium tenue, *Willd. Sp.* 5, *p.* 280. Hill-sides, Yuba River, Redwoods, and other parts of California. The indusium at first has a long lacerate apex which lies over the joint, but which finally breaks off, leaving the broad cucullate or cup-shaped base.

Aspidium munitum, *Kaulf. Enum. p.* 230; *Hook. & Arn. Bot. Beech. p.* 162. Polystichum munitum, *Presl.; Brack. l. c. p.* 203. Mountains near Oakland, and on hill-sides along the Yuba, Downieville, California. This species varies greatly in size, and in the length of its pinnæ. It is allied to A. acrostichoides of the Eastern States.

Aspidium (Lastræa) argutum, *Kaulf. l. c. p.* 242; *Hook. & Arn. l. c.* Lastræa arguta, *Brack. l. c. p.* 196. Mountain ravines, Oakland, Cajon Pass, and near San Francisco. This species

as a general resemblance to A. rigidum, *Sw.* The sori are as large as in A. marginale. When young, the stipe and rachis are thickly clothed with chaffy scales.

ASPIDIUM ACULEATUM, *Swartz; Hook. Fl. Bor.-Am.* 2, *p.* 261; *Torr. Fl. N. York*, 2, *p.* 498. Deep ravines, Napa Valley, California. Some of our specimens agree better with A. lobatum than with A. aculeatum; but we fully agree with Hooker, that these and A. angulare constitute but one species. Kutzing thinks that a part, at least, of the North American forms of A. aculeatum should be referred to A. (Polystichum) Braunii, *Spenn. Fl. Frib.*

SALVINIACEÆ.

AZOLLA CAROLINIANA, *Willd. Sp.* 5, *p.* 541; *Torr. Fl. N. York*, 2, *p.* 513. A. microphylla, *Kaulf.; Hook. & Arn. Bot. Beech. p.* 162. On the surface of slow-flowing or stagnant waters, Western New Mexico and California.

EXPLANATION OF THE PLATES.

PLATE I. CROSSOSOMA CALIFORNICA.—PAGE 63.

A BRANCH OF THE NATURAL SIZE.

Fig. 1. A branch with the leaves more fully developed, and the carpels half mature.
2. Plan of the flower.
3. A sepal.
4. A petal.
5 and 6. Front and back views of a stamen.
7. A flower, longitudinally divided, to show the insertion of the stamens; all the figures moderately and equally enlarged.
8. Transverse section of an ovary; more enlarged.
9. An ovule; considerably magnified.

PLATE II. VIOLA SHELTONII.—PAGE 67.

AN ENTIRE PLANT OF THE NATURAL SIZE.

Fig. 1. Three of the petals; enlarged.
2–4. Different views of a stamen.
5. An anther divided transversely.
6. The pistil; all the figures magnified.

PLATE III. THAMNOSMA MONTANUM.—PAGE 73.

TWO BRANCHES OF THE NATURAL SIZE—ONE IN FLOWER, THE OTHER IN FRUIT.

Fig. 1. Plan of the flower.
2. A separate flower; moderately enlarged.
3. The same, with the calyx and petals removed.
4. Immature fruit, showing the gynophore or prolongation of the glandular disk.
5. Ovary, with one of the carpels longitudinally divided; and,
6. The same transversely divided; magnified.
7. An ovule; more magnified.
8. The fruit; enlarged.
9. Seed, longitudinally divided; magnified.

PLATE IV. HOSACKIA INCANA.—PAGE 79.

A PLANT OF THE NATURAL SIZE.

Fig. 1. The banner, a wing, and one of the keel-petals; considerably magnified.
2. Stamineal tube, laid open; equally magnified.
3. The pistil, longitudinally divided; also equally magnified.
4. An ovule; highly magnified.

PLATE V. SPIRÆA MILLEFOLIUM.—PAGE 83.

UPPER PART OF THE PLANT OF THE NATURAL SIZE.

Fig. 1. Plan of the flower.
2. A petal; magnified.
3. A stamen; equally magnified.
4. Fructiferous calyx; also equally magnified.
5. A separate carpel.

Plate VI. HORKELIA TRIDENTATA.—Page 84.

AN ENTIRE PLANT OF THE NATURAL SIZE.

Fig. 1. An expanded flower and two buds; enlarged.
2. The flower laid open; a little more enlarged.
3. A petal; magnified.
4. A stamen; more magnified.
5. The head of pistils.
6. An achenium, with its persistent style.

Plate VII. WHIPPLEA MODESTA.—Page 90.

AN ENTIRE PLANT OF THE NATURAL SIZE.

Fig. 1. A separate flower; moderately enlarged.
2. A sepal; and,
3. A petal; both a little more enlarged.
4. Front view of a stamen.
5. Back view of the same; equally magnified.
6. Pistil, transversely divided; more magnified.
7. An ovule; more magnified.
8. A flower, longitudinally divided; considerably magnified.
9. Plan of the flower.

Plate VIII. CORNUS SESSILIS.—Page 94.

A BRANCH OF THE NATURAL SIZE.

Fig. 1. Umbel of flowers and involuere.
2. The involuere; shown separately.
3. An exterior leaf of the same.
4. Interior leaf of the same.
5. A separate flower.
6. The same, with two of the petals and stamens removed to show the teeth of the calyx.
7. The fruit.

Plate IX. HOFMEISTERIA PLURISETA.—Page 96.

A PLANT OF THE NATURAL SIZE.

Fig. 1. A separate flower; enlarged.
2. The corolla of the same laid open; more magnified.
3. A stamen; still more magnified.
4. Two paleæ and a hair of the pappus; more magnified.
5. An achenium, crowned with its pappus; considerably magnified.
6. Involuere and receptacle; moderately magnified.

Plate X. ASTER BIGELOVII.—Page 97.

UPPER PORTION OF THE PLANT OF THE NATURAL SIZE.

Fig. 1. A ray flower.
2. A branch of the style from the same.
3. A disk flower.
4. A separate stamen from the same.
5. Style and its branches, from a disk flower.
6. An achenium.
7. A hair of the pappus; highly magnified.

PLATE XI. APHANTOCHÆTA EXILIS.—PAGE 100.

A PLANT OF THE NATURAL SIZE.

Fig. 1. A head of flowers, moderately enlarged.
2. Involuere and receptacle, from which the flowers have fallen, more enlarged.
3 and 4. Scales of the involuere, equally magnified.
5. A pistillate flower.
6. A perfect flower.
7. A stamen, highly magnified.
8. Summit of the style of a pistillate flower, equally magnified.
9. Style of a perfect flower, equally magnified.
10. An achenium, enlarged.

PLATE XI. EVAX CAULESCENS.—PAGE 101.

Fig. 1. A plant of the natural size.
2. A head of flowers ; vertical section, enlarged.
3. Involuere and receptacle ; more enlarged.
4. Inside view of one of the paleæ from the summit of the receptacle.
5. A male flower.
6. A stamen, from the same.
7. One of the paleæ subtending the female flowers.
8. A female flower.
9. An achenium ; the details all magnified.

PLATE XII. LINOSYRIS BIGELOVII.—PAGE 98.

A BRANCH OF THE NATURAL SIZE.

Fig. 1. A flower ; enlarged.
2. A stamen ; magnified.
3. The style ; more magnified.
4. An achenium, with its pappus ; enlarged.
5. Receptacle ; enlarged.

PLATE XIII. STYLOCLINE GRAPHALOIDES.—PAGE 101.

A PLANT OF THE NATURAL SIZE.

Fig. 1. Involuere and receptacle.
2. Receptacle, with a male flower on its summit, and its subtending palea.
3. A stamen.
4. One of the fertile flowers enclosed in its large palea.
5. Dorsal view of a fertile palea.
6. Vertical view of the same.
7. Transverse section of the same ; to show the way in which the achenium is enclosed in a dorsal fold of the palea.
8. A fertile flower.
9. An achenium ; the details variously magnified.

PLATE XIV. QUERCUS ECHINACEA.—PAGE 137.

A BRANCH OF THE NATURAL SIZE.

Fig. 1. A leaf without serratures.
2. An acorn ; both figures of the natural size.

PLATE XV. SYNTRICHOPAPPUS FREMONTII.—PAGE 106.

AN ENTIRE PLANT OF THE NATURAL SIZE.

Fig. 1. Involuere and receptacle.
2. A ray flower.
3. A disk flower.
4. A separate stamen.
5. Style and its branches.
6. Portion of the syntrichous pappus.
7. One of the leaves of the same ; highly magnified.

PLATE XVI. LAYIA PENTACHÆTA.—PAGE 108.

A FLOWERING BRANCH OF THE NATURAL SIZE.

Fig. 1. Vertical section of part of a head of flowers; enlarged.
2. A ray flower, with its embracing involucral scale.
3. A marginal palea of the receptacle.
4. A disk flower.
5. A stamen of the same; magnified.
6. Style of a ray flower; magnified.
7. Style of a disk flower; equally magnified.
8. Involucre and receptacle; enlarged.
9. Achenium of a ray flower without its scale.
10. Achenium of a disk flower, with its pappus; the details variously magnified.

PLATE XVII A. CALAIS BIGELOVII.—PAGE 113.

A PLANT OF THE NATURAL SIZE.

Fig. 1. A separate flower; magnified.
2. Divisions of the style, showing the stigmatic lines; highly magnified.
3. An exterior achenium, and
4. An interior achenium; both moderately enlarged.
5. A separate palea of the pappus.

PLATE XVII, B. CALAIS TENELLA.—PAGE 114.

Fig. 6. A separate flower; magnified.
7. Divisions of the style; highly magnified.
8. An achenium, destitute of pappus.
9. Another achenium crowned with two awned paleæ.
10. The receptacle. The last three figures equally magnified.

PLATE XVIII. CALAIS CYCLOCARPHA.—PAGE 113.

Fig. 1. A flower; magnified.
2. A stamen; more highly magnified.
3. The style; equally magnified.
4. An achenium crowned with its pappus; magnified.
5. A single palea; equally magnified.
6. Receptacle; enlarged.

PLATE XIX. ERIOGONUM LACHNOGYNUM.—PAGE 132.

AN ENTIRE PLANT OF THE NATURAL SIZE.

Fig. 1. An involucre, from which several flowers protrude; magnified.
2. Perianth laid open; more magnified.
3. A pedicel, with a pair of bracteoles at its base; equally magnified.
3 *a*. A third and broader bracteole, inserted exterior to the others; equally magnified.
4. The pistil; more magnified.
5. A ripe achenium; considerably enlarged.
6. Embryo, from the same.

PLATE XX. OBIONE HYMENELYTRA.—PAGE 129.

Fig. 1. A branch, with male flowers, of the natural size.
2. A branch from a female plant, with fruit, of the natural size.
3. A male flower; magnified.
4. A female flower; also magnified.
5. The same, with one bract removed to show the pistil; more enlarged.
6. Embryo; considerably magnified.

PLATE XXI. DAMASONIUM CALIFORNICUM.—PAGE 142.

AN ENTIRE PLANT OF THE NATURAL SIZE.

Fig. 1. Plan of the flower.
2. A flower; somewhat magnified.
3. One of the sepals; also magnified.
4. An anther; more magnified.
5. A pistil, laid open to show the position of the ovule.
6. A ripe achenium; considerably magnified.
7. Seed; still more magnified.

PLATE XXII. SCOLIOPUS BIGELOVII.—PAGE 145.

A PLANT OF THE NATURAL SIZE.

Fig. 1. A separate flower.
2. A sepal, with a stamen, seen anteriorly.
3. A petal.
4. Anther, with part of the filament, posterior view.
5. Pistil, with the ovary divided transversely; a petal and a stamen.
6. Portion of the ovary divided transversely and vertically.
7. An ovule. The details, except figure 1, more or less magnified.

PLATE XXIII. STROPHOLIRION CALIFORNICUM.—PAGE 149.

AN ENTIRE PLANT OF THE NATURAL SIZE.

Fig. 1. The perianth laid open; moderately enlarged.
2. The pistil; more enlarged.
3. A ripe pod, showing the dehiscence.
4. One of the carpels of the same, laid open and showing the seed.
5. Transverse section of a pod.
6. A seed; considerably magnified.
7 and 8 should be erased.

PLATE XXIV. ODONTOSTOMUM HARTWEGII.—PAGE 150.

AN ENTIRE PLANT (EXCLUSIVE OF THE ROOT) OF THE NATURAL SIZE.

Fig. 1. The unopened perianth; magnified.
2. Flower laid open; equally magnified.
3. A stamen; more magnified.
4. Part of the ovary; longitudinally divided and magnified.
5. An ovule; also magnified.
6. Transverse section of an ovary.
7. Immature fruit.

PLATE XXV. *CORALLORHIZA STRIATA.—PAGE 152.

A PLANT OF THE NATURAL SIZE, IN FLOWER AND FRUIT.

Fig. 1. A flower; moderately enlarged.
2. Lip of the same; magnified.
3. The column; equally magnified.

* Incorrectly named C. Macræi on the plate.

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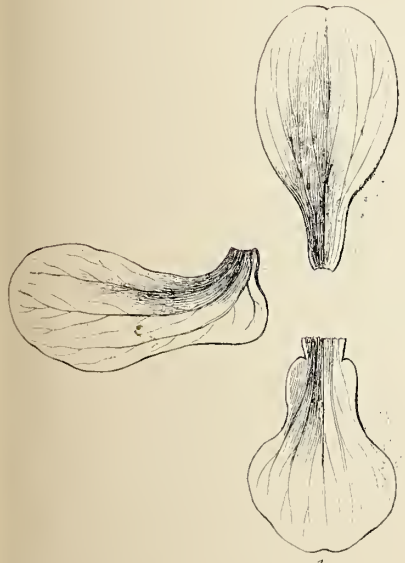
CROSSOSOMA CALIFORNICA.



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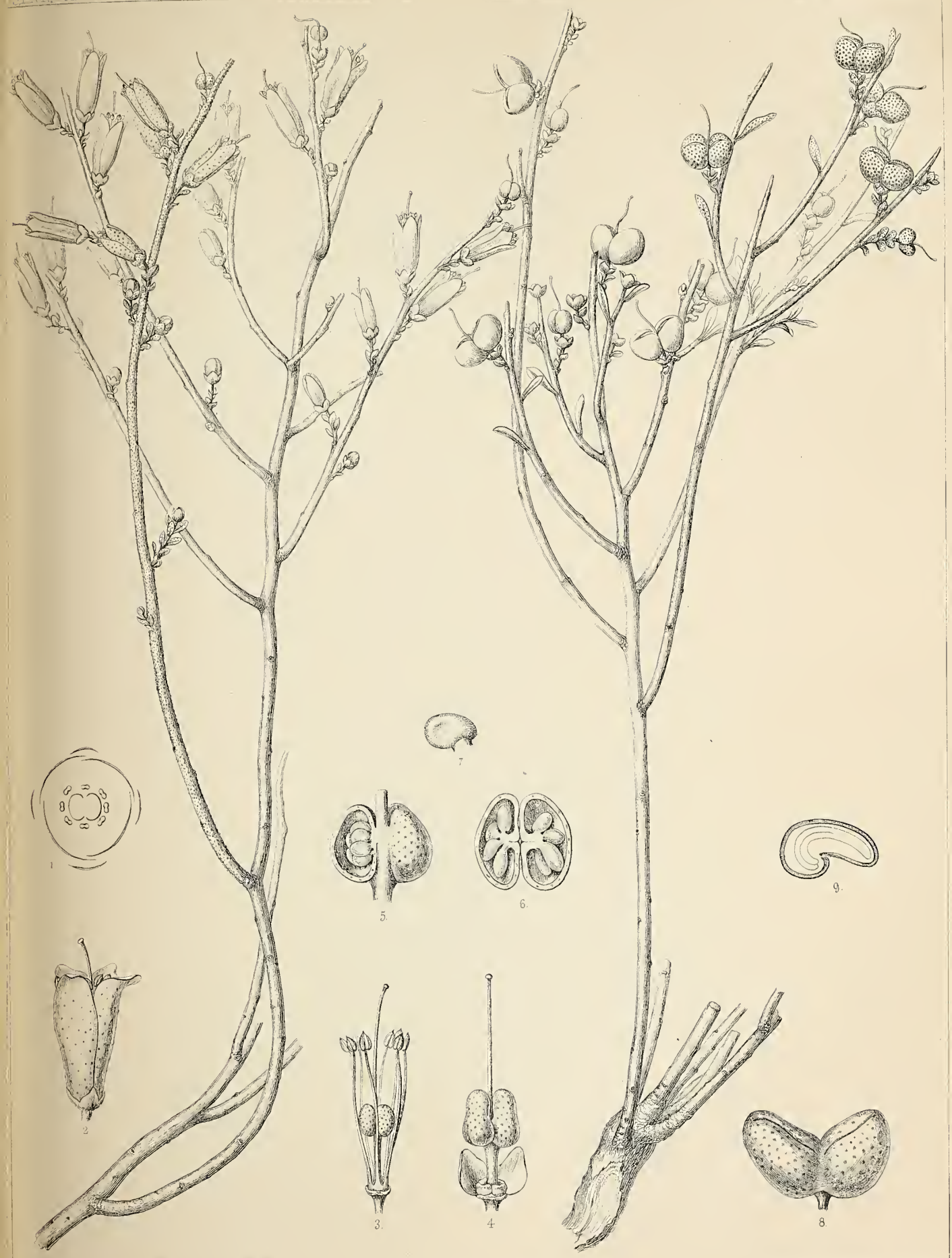
VIOLA SHELTONII.



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THAMNOSMA MONTANUM

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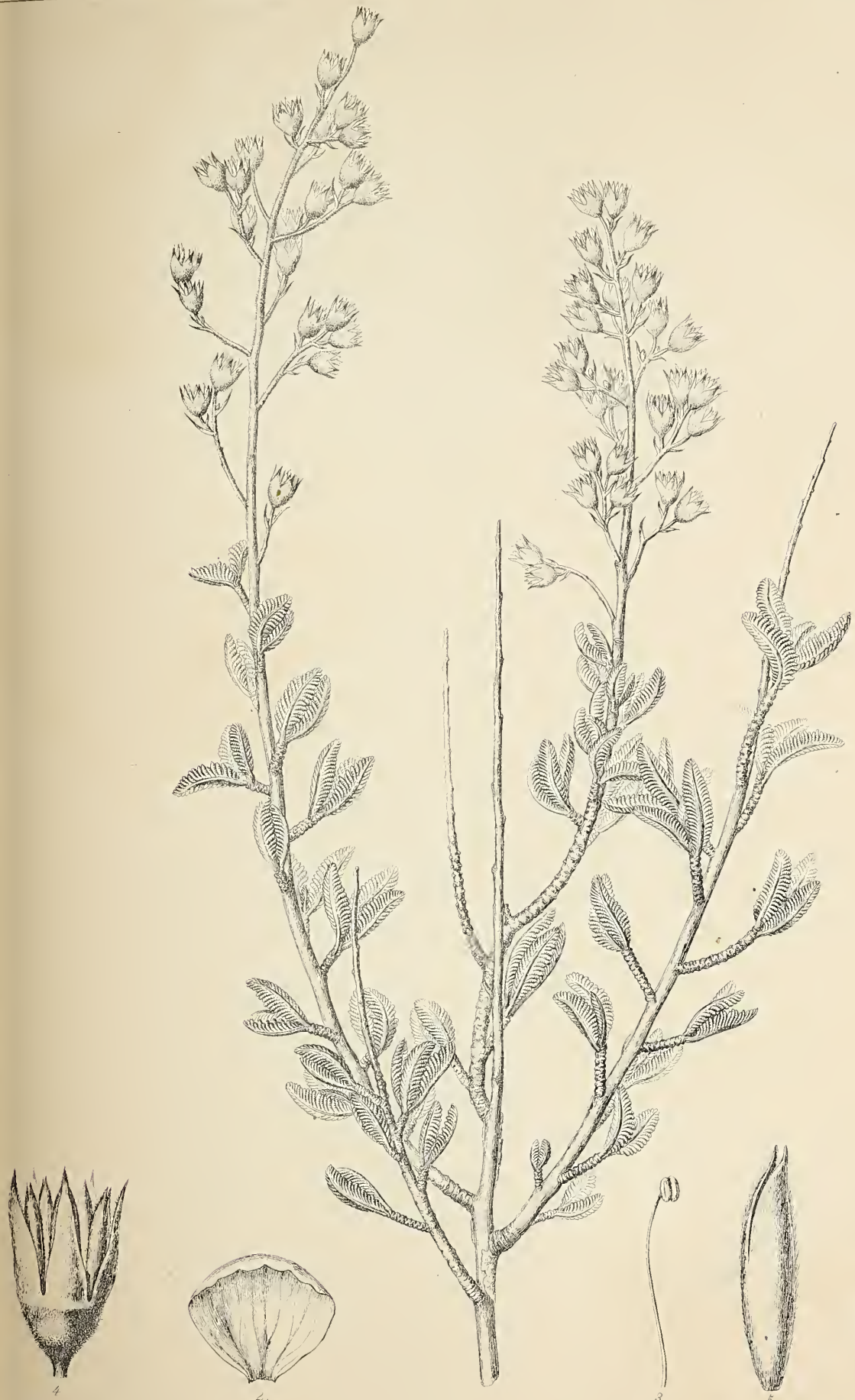
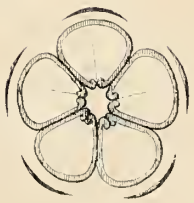
HOSACKIA INCANA.





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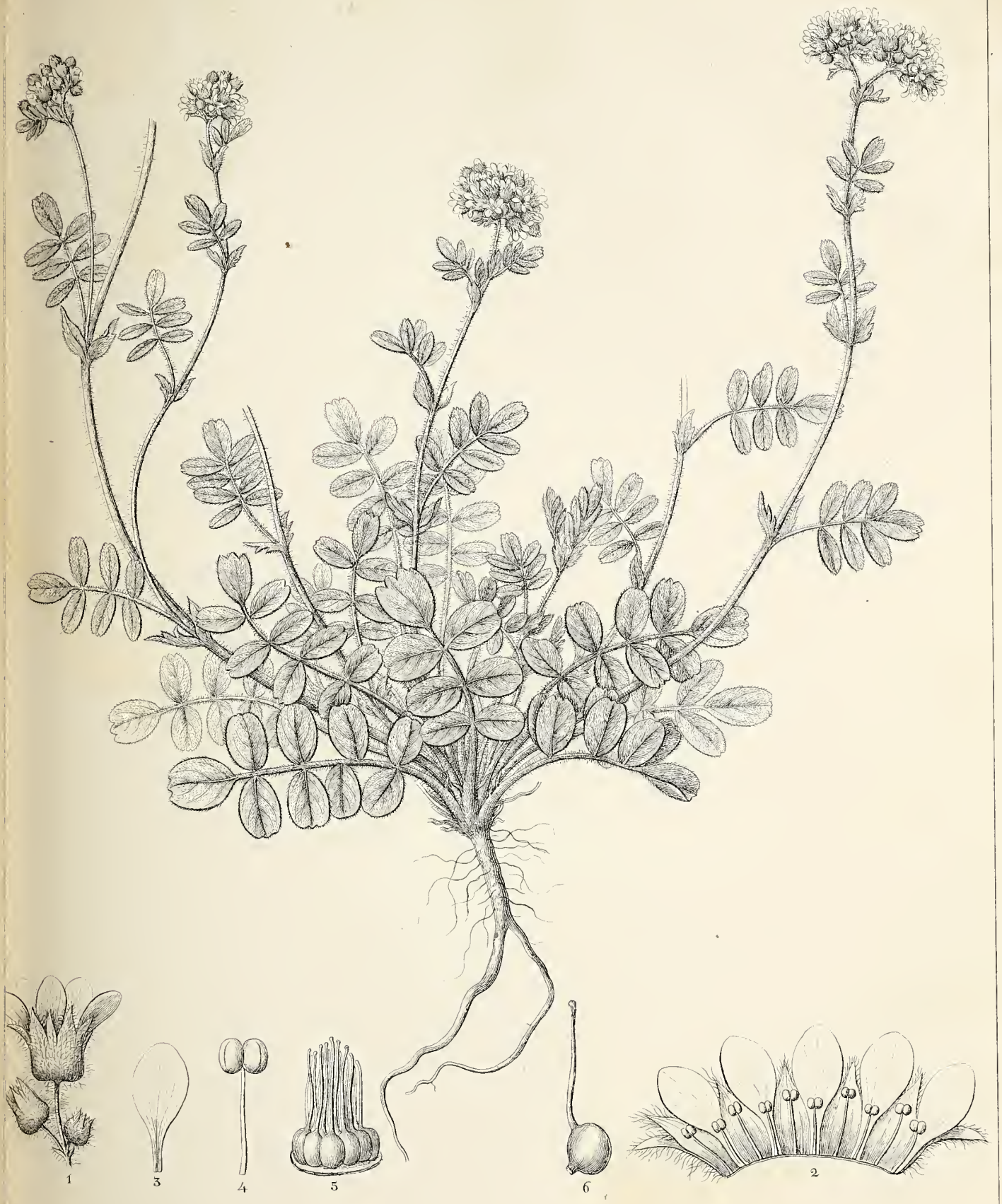
SPIRÆA MILLEFOLIUM.



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HORKELIA TRIDENTATA.

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WHIPPLÆA MODESTA.

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CORNUS SESSILIS.

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HOFMEISTERIA PLURISETA.

APHANTOCHAETE EXILIS

Ackerman Lith. 379 Broadway N.Y.

EVAX CAULESCENS.

Ackerman, Lith. 79 Broadway N.Y.

ASTER BIGELOVII.

Ackerman Luh. 376 Broadway, N.Y.

LINOSYRIS BIGELOVII.

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STYLOCLINE GNAPHALOIDES.

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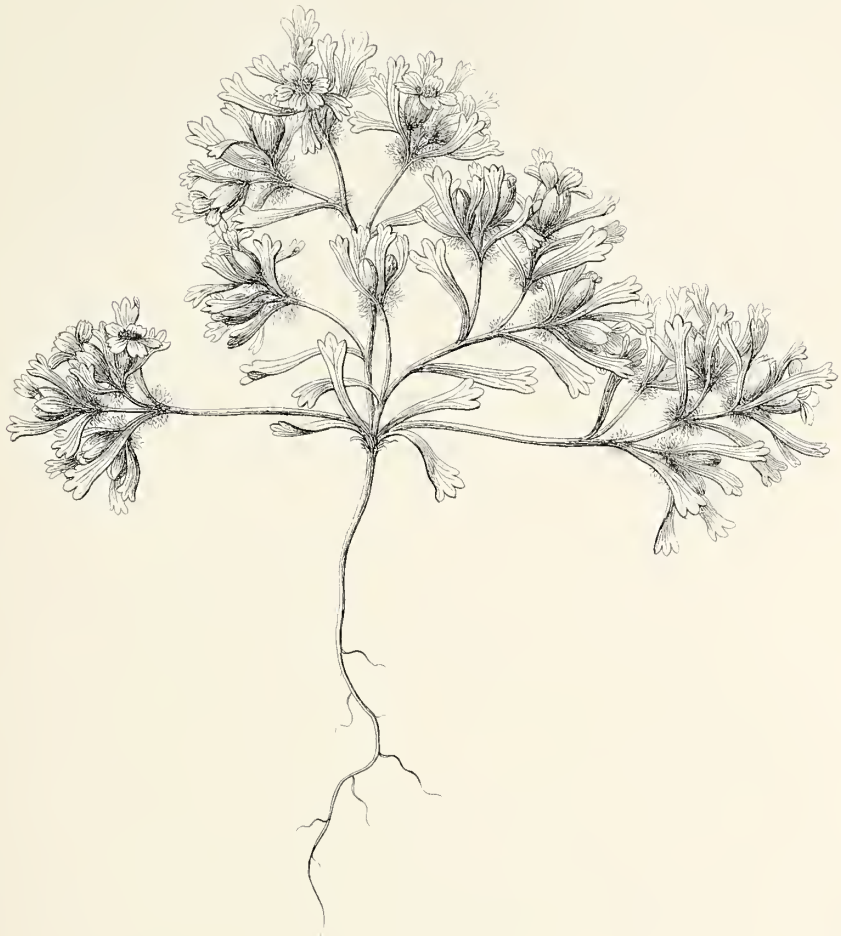
QUERCUS ECHINACEA.



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SYNTRICHOPAPPUS FREMONTII.

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LAYIA PENTACHÆTA

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CALAIS BIGELOVII.

CALAIS TENELLA.

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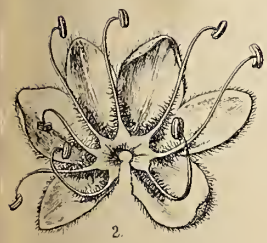
CALAIS CYCLOCARPHA.

1.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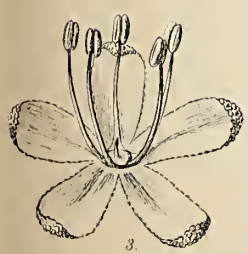
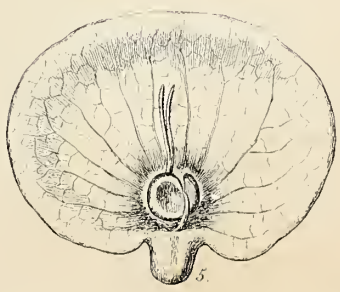
ERIOGONUM LACHNOGYNUM





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OBIONE HYMENELYTRA.

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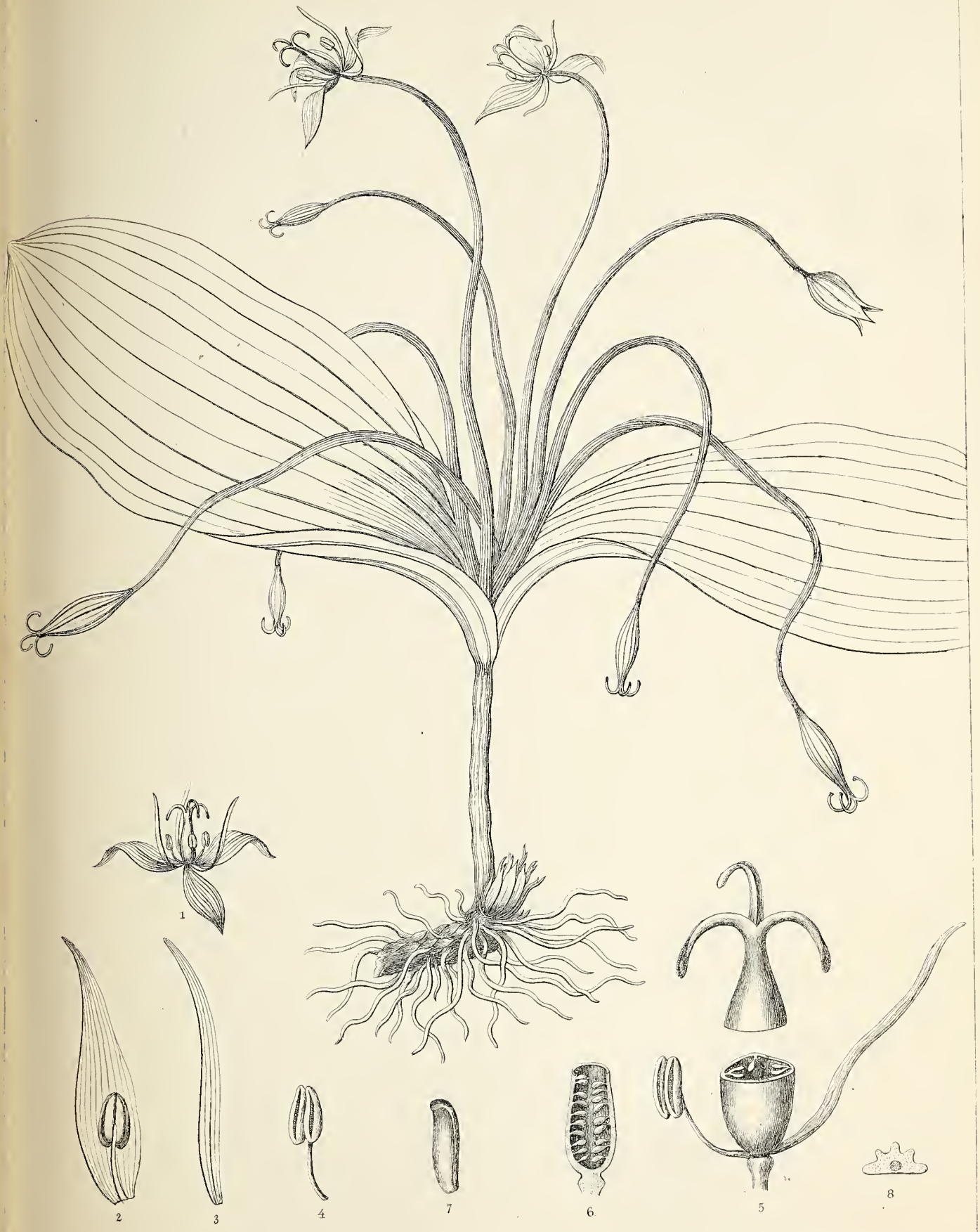
ALISMA CALIFORNICA.



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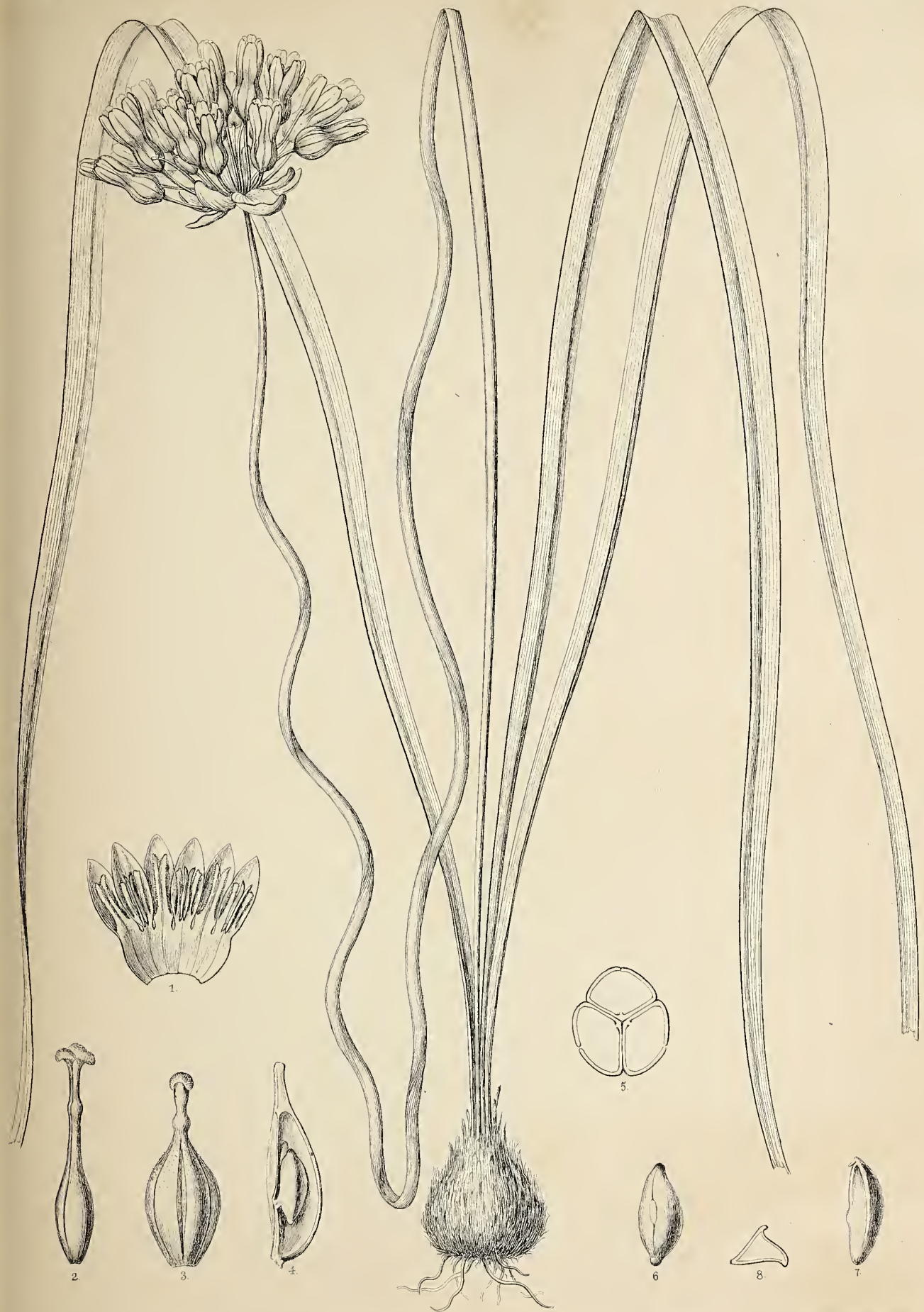
SCOLIOPUS BIGELOVII.



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STROPHOLIRION CALIFORNICUM.

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ODONTOSTOMUM HARTWEGI

CORALLORHIZA MACRÆI

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*From some misunderstanding, the types have been reversed from their ordinary use in such cases. This was discovered after the index was set up, and it was too late to make the change. The author thinks it is proper to state that, owing to his distance from the press, and the rapidity with which the printing was done, he was not able to revise the proofs.

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No. 5.

DESCRIPTION OF THE MOSSES AND LIVERWORTS.

BY W. S. SULLIVANT.

MUSCI.

WEISSIEÆ.

GYMNOSTOMUM CALCAREUM, *Nees & Hornsch.; Bryol. Europ. Gymnost. monogr.*, *p.* 6, *t.* 3 *and* 4: var. perpusilla, foliis erectis ovato-lanceolatis margine crenulatis, capsula pyriformi-ovali. On clayey soil, near San Francisco.

G. CURVIROSTRUM, *Hedw.; Bryol. Europ. Gymnost. monogr.*, *p.* 8, *t.* 7 *and* 8. Wet rocks, Leroux's springs, base of San Francisco mountain, Mogollan range.

WEISSIA VIRIDULA, *Brid.; Bryol. Europ. Weis. monogr.*, *p.* 5, *t.* 2 *and* 3. Various places on the ground.

W. CIRRHATA, *Hedw.; Bryol. Europ. Weis. monogr.*, *p.* 9, *t.* 6. On the prostrate trunk of a Wellingtonia "mammoth tree grove."

DICRANEÆ.

CERATODON PURPUREUS, *Brid.; Bryol. Europ. Cerat. monogr.*, *p.* 5, *t.* 1; var. xanthopus. Near San Francisco; appears to differ from the normal form in nothing but the pale yellow pedicels.

A large Campylopus (?) was found growing with Weissia cirrhata, but not in a fit state for determination.

FESSIDENTEÆ.

FESSIDENS LIMBATUS, (sp. nov.): monoicus pusillus acrocarpus; foliis 8–10 jugis oblongis hyalino-marginatis apice excepto, lamina apiciali duplicaturam inferne latisime marginatam vix æquante; capsula sub ovali inæquali cernua; perist. dentibus maxime introflexis. Near San Francisco; about the size of F. bryoides, from which it is distinguished by its cernuous capsule, the deep insertion of its peristomial teeth, and the denser areolation of its leaves, remarkable for the broad margin of their complicate portion. (Plate I.)

TRICHOSTOMEÆ.

TRICHOSTOMUM TOPHACEUM, *Brid.; Bryol. Europ. Trichost. monogr.*, *p.* 9, *t.* 6. Cajon Pass, Sierra Nevada; also, near San Francisco.

T. FLEXIPES, *Bryol. Europ. Trichost. monogr.*, *p.* 6, *t.* 2. Near San Francisco.

T. CORNICULATUM, *Schwœgr. Suppl.* 2, 1, *p.* 75, *t.* 118. With the last.

BARBULA MEMBRANIFOLIA, *Schultz; Bryol. Europ. Barb. monogr.*, *p.* 17, *t.* 3. Dry ravines on Williams' fork of the Great Colorado, near the mouth of Santa Maria Creek.

B. CHLORONOTOS, *Schultz; Bryol. Europ. Barb. monogr.*, *p.* 18, *t.* 4. Hab. same as the last.

B. FALLAX, *Hedw.; Bryol. Europ. Barb. monogr.*, *p.* 23, *t.* 9. Cajon Pass, Sierra Nevada; also near San Francisco.

B. BRACHYPHYLLA, (sp. nov.): dioica; dense cæspitosa; caule fastigiato-ramosa; foliis patentibus ovatis breviter obtuse acuminatis toto margine recurvis usque ad apicem valido-costatis; capsula cylindracea erecta; perist. dentibus vix contortis e membrana basilari perangusta ortis; annulo simplici; operculo longe rostrato; calyptra brevi. Near Benicia. Stems 8–12 lines high, rooting profusely their entire length, and branching from below the floral apex. Leaves dark, brownish green, of a firm, thick texture; cellules minute sub-quadrate. Pedicel 5–7 lines high, red. Teeth of the peristome contorted scarcely half-way round. This species has the habit and aspect of a Trichostomum, particularly of T. rigidum, but each of the 32 teeth of its peristome consists of two conjoined lines of tubular cellules, one placed before the other. (Plate II.)

B. VINEALIS, *Brid.; Bryol. Europ. Barb. monogr.*, *p.* 24, *t.* 10. Oakland, opposite San Francisco; also Sonora.

B. SEMITORTA, (sp. nov.): dioica; laxe cæspitosa; caulibus subsimplicibus basi solum radicantibus apice congesto-foliosis; foliis e basi erecta amplexante horizontalibus lineari-lanceolatis concavis margine planis, costa solida cum apice desinente; capsula cylindracea erecta aciculari-operculata, anguste annulata; perist. dentibus longiusculis semitortis; calyptra vix infra operculum descendente. Growing with the last species, which it resembles, but has a shorter calyptra, longer operculum, and less contorted peristome, with a narrower basal membrane. Its leaves are more tufted at the top of the stems, squarrose-spreading, gradually tapering from near their base, (not suddenly and long acuminated,) with margins nowhere recurved; areolation much larger. (Plate III.)

B. CONVOLUTA, *Hedw.; Bryol. Europ. Barb. monogr.*, *p.* 29, *t.* 16.—Oakland, opposite San Francisco.

B. VAHLIANA, *Schultz; Bryol. Europ. Barb. monogr.*, *p.* 33, *t.* 18.—Cajon Pass, Sierra Nevada; also near Los Angeles.

B. MARGINATA, *Bryol. Europ. Barb. monogr.*, *p.* 33, *t.* 19.—Dry rocky places, common.

B. SUBULATA, *Brid.; Bryol. Europ. Barb. monogr.*, *p.* 36, *t.* 21 and 22.—Dry ravines on Bill Williams' fork of the Rio Colorado, near the mouth of Santa Maria creek.

B. INERMIS, *Mont.; Byrol. Europ. Barb. monogr.*, *Suppl.* 3.—At the base of a mountain fifty miles west of the Rio Colorado in the line of the survey.

B RURALIS, *Hedw.; Bryol. Europ. Barb. monogr.*, *p.* 43, *t.* 27.—Cajon Pass, Sierra Nevada.

B. MULLERI, *Bryol. Europ. Barb. monogr.*, *p.* 44, *t.* 28.—Various localities; appears to be a common species.

POTTIEAE.

POTTIA SUBSESSILIS. *Bryol. Europ. Pott. monogr.*, *p.* 6, *t.* 1.—Los Angeles.

P. MINUTULA, *Bryol. Europ. Pott. monogr.*, *p.* 8, *t.* 3.—Growing with the last.

ORTHOTRICHEAE.

ORTHOTRICHUM LYELLII. *Hook.; Bryol. Europ. Orthot. monogr.*, *p.* 27, *t.* 16.—Growing on trees; not uncommon in California and Oregon. Differs from the European form in its longer and narrower leaves, more undulate on the margins, and more contorted when dry. The articulated gland-like bodies, (Converfa Orthotrichi,) so frequent on the leaves of European specimens, are seldom present on the Californian. It is the var. foliis longioribus siccitate magis crispatis, (*Brid. Bryol. Univ.* 1, *p.* 728.) founded on specimens collected by Menzies at Nootka Sound.

In the collection are imperfect specimens of another Orthotrichum gathered at the crossing of the Colorado, growing with Schistidium apocarpum, and also on rocks at Lereux's spring,

near the foot of San Francisco mountain, Mogollan range, which apparently belong to O. cupulatum.

GRIMMIEÆ.

SCHISTIDIUM APOCARPUM, *Bryol. Europ. Schistid. monogr., p.* 7, *t.* 3.—On rocks at the crossing of the Rio Colorado.

GRIMMIA CALIFORNICA, (sp. nov.): dioica; laxe cæspitosa; foliis erecto-patentibus elongato-lanceolatis carinoto-concavis margine revolutis, costa in acumen hyalinum denticulatum excurrente; capsula ovali oblongave, sub-pyriformi pendula, sicca vix costata; pedicello breviusculo arcuato; operculo recte longe rostrato; calyptra dimidiato-mitriformi basi 4—5 fissa; annulo majusculo triplici; peristom. dentibus bifidis.—Oakland, opposite San Francisco; also near Sonora. Approaches near to G. trichophylla, *Grev.;* but that has less crowded, longer, more slender, and flexuous leaves, and capsules distinctly and prominently ribbed when dry, with subflexuous and longer pedicels.

G. Olneyi, *Sulliv.*, a more closely related species, is not so robust; has leaves canaliculate-concave not recurved on the margin; when flattened, linear-lanceolate from an ovate base, and the teeth of the peristome perforated (not bifid) at their apices.

G. Californica differs from both species in the more or less obovate outline of its capsule, with an evident collum.

In the same habitat occurs a variety differing from the typical form in the strong recurvation of its leaves, an unusual feature in this genus, and which is to be found in only one other published species, the Algerian Grimmia ancistrodes, *Mont.*, which, according to original specimens from Dr. Montagne, is likewise dioecious, not monoecious, as stated in his Sylloge. This variety may prove to be a distinct species. (Plate IV.)

G. TRICHOPHYLLA, *Grev.; Bryol. Europ. Grimm. monogr., p.* 16, *t.* 9.—Shaded rocks, near Benicia.

G. PULVINATA, *Smith; Bryol. Europ. Grimm. monogr. p.* 12, *t.* 4.—Rocks on Bill Williams' fork, near the mouth of Santa Maria Creek. There occurs in the collection sterile specimens of a Grimmia agreeing very well with G. commutata; locality not mentioned.

HEDWIGIEÆ.

HEDWIGIA CILIATA, *Ehrh.; Bryol. Europ. Hedwig. monogr., p.* 5, *t.* 1 and 2.—On rocky cliffs, head waters of Bill Williams' fork, near the Aztec Pass.

POLYTRICHEÆ.

POLYTRICHUM JUNIPERINUM, *Hedw.; Bryol. Europ. Polyt. monogr., p.* 12, *t.* 15.—Hillsides near Downieville, on the Yuba river.

P. PILIFERUM, *Bryol. Europ. Polyt. monogr., p.* 11, *t.* 14.—Rocky places above Sonora, base of the Sierra Nevada.

BRYEÆ.

AULACOMNION ANDROGYNUM, *Schwœgr.; Bryol. Europ. Aulacom., monogr., p.* 11, *t.* 4.—On the ground, or on much-decayed logs. A common species in Oregon and California, somewhat larger than the European form, and, unlike it, fruits copiously.

BRYUM TOZZERI, *Grev.; Bryol. Europ. Bry., monogr., p.* 41, *t.* 16.—Coast mountains near Oakland.

B. PYRIFORME, *Hedw.; Bryol. Europ. Bry., monogr., p.* 45, *t.* 18.—Banks of streams, Quiqualmungo Ranch, near the Cajon Pass.

B. BIGELOVII, (sp. nov.): dioicum; laxe cæspitosum elatum multoties innovando-ramosum ex apice ramulosum; foliis caulis innovationumque inferne parvis distantibus ascendendo majoribus imbricantibus erecto-patentibus oblongo-ovatis (comalibus lanceolato-acuminatis) concavis margine subintegro vix recurvis, costa valida percurrente vel infra apicem desinente; capsula alte

pedicellata sub pendula pyriformi-elliptica: flore masculo terminali capituliformi. Banks of streams above Sonora, base of the Sierra Nevada. The dark yellowish-green of the foliage; the shorter, more obtuse, and nearly entire leaves, with a closer areolation; the less obovate capsule, and the capituliform male flowers of this species, separate it from B. Wahlenbergii, its nearest congener. (Plate V.)

B. ARGENTEUM, *Linn.; Bryol., Europ., Bry., monogr., p.* 78, *t.* 41.—On rocks, dry ravines, fifty miles west of the Rio Colorado, on the line of the survey.

B. CALIFORNICUM, (sp. nov.): dioicum? dense cæspitosum; caule atque innovationibus brevissimis bulbiformibus; foliis inferne dissitis superne majoribus densissime capituliformi-imbricatis concavis subquadrato-ovatis breviter apiculatis, margine subintegerrimis subplanisque, continuo-costatis; capsula atro-sanguinea oblonga vel oblongo-ovata pendula, collo haud angustiore siccatate rugoso basi obtusato; operculo minuto hemisphærico; peristomii dentibus dilute purpurascentibus profunde insertis remotius articulatis, ciliolis singulis brevibus exappendiculatis; annulo magno revolubili. Near Benicia. This species, compared with B. atropurpureum, has a more compact mode of growth, leaves broader, shorter, less acuminate, and of a subquadrate or obovate-quadrate outline, costa not excurrent, and capsule with a collum as long and as broad as the sporangium.

In B. versicolor, another nearly allied species, the pedicel at the base of the capsule is more suddenly bent, and the branches somewhat julaceous, with leaves longer, more acuminate, and cuspidate by the excurrent costa.

B. Californicum is best distinguished from either of these species by its short bulb-like stems and branches, its very small conic-hemisphærical operculum, and the deep insertion below the rim of the capsule of its peristomial teeth. The inner peristome is seldom well developed.

B. Blindii has a globose-pyriform capsule, with a tapering and much smaller collum; its peristome and the areolation of the leaf are also different. (Plate VI.)

B. OBCONICUM, *Hornsch.; Bryol., Europ., Bry., monogr., p.* 59, *t.* 37.—Near San Francisco and Napa City.

Specimens, partly incomplete, of a Bryum collected in Mammoth Tree Grove, on the decayed trunks of trees, may belong to this species. The capsules, however, are shorter and less clavate, and the comal leaves longer and more gradually acuminate, and the habitat, on decayed wood, unusual.

B. INTERMEDIUM, *Brid.; Bryol., Europ., Bry., monogr., p.* 47, *t.* 19.—Var. foliis elongato-oblongis sensim acuminatis. No locality given. The capsules are in various stages of development, as is common in this species.

B. TORQUESCENS; *Bryol., Europ., Bry., monogr., p.* 49, *t.* 20.—Var. foliis latioribus densius areolatis siccis minus contortis. Oakland, opposite San Francisco.

B. OCCIDENTALE, (sp. nov.): dioicum, brunnescens; caule brevi inferne defoliato tomentoso superne congesto-folioso; innovationibus gracilescentibus in media longitudine incrassatis; foliis ellipticis breviter acuminatis (perichætialibus oblongo-lanceolatis) costa valida excurrente cuspidatis, decurrentibus margine subintegerrimis vix recurvis, reticulo rhombeo-hexagono cellulis inferioribus subquadratis; capsula pendula oblonga vel oblongo-obconica macrostoma; peristomio normali ciliolis ternatim interjectis exappendiculatis; annulo permagno; operculo convexo-apiculato: planta mascula graciliore innovando-continua: flore terminali gemmiformi polyphyllo. Near San Francisco. This species is separated from the nearly related B. cæspiticium by its erect, appressed, decurrent, scarcely margined leaves, not so acuminate nor so long-cuspidate, by their heavier costa, with a denser texture, composed, in their lower half, of quadrate cellules. It has also an oblong and smaller capsule, with but a slight tendency to a pyriform outline, a wider and reddish (not yellowish) operculum, and a larger annulus. (Plate VII.)

MNIUM MENZIESII, *Hook. in Botanic. Miscell.* 1, *p.* 36, *t.* 19; Hypnum acanthoneuron, *Schwœgr. Suppl. t.* 258. Common on the coast range of mountains; fruit rare.

FUNARIEÆ.

FUNARIA HYGROMETRICA, *Hedw.; Bryol. Europ. Funar. monogr. p.* 8, *t.* 4. Various places.

F. MUHLENBERGII, *Schwœgr.; Bryol. Europ. Funar. monogr. p.* 6, *t.* 1. Near the crossing of the Rio Colorado on the line of the survey.

F. HIBERNICA, *Hook.; Bryol. Europ. l. c. p.* 7, *t.* 2. Cajon Pass, Sierra Nevada.

FONTINALEÆ.

FONTINALIS CALIFORNICA, (sp. nov.): caulibus flaccidissimis multoties divisis ramosis, ubique foliosis; foliis concavis patentibus distantibus late ovalibus laxiuscule arcolatis, cellulis utriculo primordiali subsoluto instructis; fructu non viso. Rivulets in the coast range of mountains north of the bay of San Francisco.

Resembles F. Eatoni, *Sulliv.*, but is a somewhat smaller plant, with more distant and spreading, shorter, broader, and less acuminated leaves of a looser areolation, composed of shorter and wider cellules, in which the primordial utricle is more or less conspicuous; color reddish-brown or copperish.

The species of this genus have each a peculiar aspect or facies, (difficult to describe,) which is little liable to variation in consequence of the uniformity of their habitat. Their sporules have a diameter of about $\frac{1}{125}$ of a line, not $\frac{1}{225}$, as erroneously stated in the second edition of Gray's Manual of Botany.

LEUCODONTEÆ.

PTERIGYNANDRUM FILIFORME, *Hedw.; Bryol. Europ. Pterigyn. monogr. p.* 3, *t.* 1. Near San Francisco; on trees.

PTEROGONIUM GRACILE, *Swartz.; Bryol. Europ. Pterogon. monogr. p.* 4, *t.* 1. With the last.

ALSIA CALIFORNICA, *Sulliv. in Proceed. Amer. Acad. of Arts and Sci., Jan.*, 1855; also in *Cryptogam. of the U. S. Exp. Expedition, t. XXV, ined.;* Neckera Californica, *Hook. & Arn. in Beechy's Voy. p.* 162. On trees; not uncommon.

LEPTODON CIRCINATUS, (sp. nov.): dioicus; ramis primariis e rhizomate horizontali oriundis inferne nudiusculis superne dense frondiformi-pinnatis (siccitate circinatis) paraphyllosis; foliis quinquefariam imbricatis erecto-patentibus lanceolatis acuminatis subcarinato-concavis evanidicostatis dorso papillosis margine parum recurvis superne serrulatis, retis pellucidæ areolis minutis chlorophyllosis ovali-rhombeis e costa radiatim seriatis alaribus subquadratis confertioribus; floribus masculis substipitatis axillaribus secus rachim utrinque crebre dispositis; antheridiis numerosis copiose paraphysatis; fructu ignoto. Coast range of mountains south of San Francisco. Grows in dark-green cushion-like masses. The main stem or rhizoma hard, woody, buried in the soft bark of trees, and throwing out at right angles numerous elastic primary branches—$1\frac{1}{2}$ to 2 inches long—of which the lower half is simple, the upper expanded into a densely pinnated ovate frond, circinate when dry. The simply pinnate ramification of the primary branches, and the shape of the leaf, separate this species from its cogeners. (Plate I.)

ANTITRICHIA CURTIPENDULA, *Brid.; Bryol. Europ. Antitric. monog. p.* 2, *t.* 1. Oakland, opposite San Francisco. The specimens are without fruit, and differ from the normal form (which has likewise been found in California) in its julaceous branches, and shorter and more crowded leaves, resembling the var. Hispanica, which occurs mostly in the south of Europe.

HYPNEÆ.

HYPNUM BIGELOVII, (sp. nov.): dioicum, subdendroideum; surculis e caule rhizomatoidea arcuato-ascendentibus fasciculato-ramosis, ramis ramulisque complanatis; foliis patentissimis bifariis elongato-oblongis breviter acuminatis apice serratis subplanis, marginibus uno latere inflexis, costa sub apice evanida, areolatione densa superne rhombea inferne oblonga parenchy-

matosa; perichætialibus lanceolatis lineali-acuminatis serratis evanidicostatis; capsula ovali subæquali inclinata collo distincto instructa; pedicello cygneo crassiusculo; operculo conico-rostrato; calyptra cuculliformi; annulo composito; perist. dentibus lineali-lanceolatis dense articulatis, ciliis e membrana lata plicata lanceolatis carina hiantibus, ciliolis binis nodosis. Valleys of the coast range of mountains north of and near to the bay of San Francisco. Plant 1–1½ inches high, growing in close mats. Stems rather stiff and elastic, with shining bright green leaves, striate when dry. Pedicils aggregated, and arising mostly from near the base of the larger branches. (Plate VIII.)

This species appears to be near Leskea gymnopoda, as proposed by Taylor in London Journal of Botany, 1846, p. 65, but that species is there described as having attenuated branches, ovate-lanceolate, semi-costate leaves, and a Leskeoid peristome.

The description of Hypnum expansum *Tayl.* l. c., p. 65, except in the less dendroid habit subpinnate ramification and gradually acuminated leaves, applies very well to our species; both, however, of the Taylorean species just named are considered by Mr. Wilson, (than whom there is no higher authority,) with authentic specimens before him, one and the same, and identical with Neckera longirostris, *Hook.*, of which we have authentic specimens, clearly showing it to be quite distinct from Hypnum Bigelovii.

Our species is interesting as being the most northern representative of a group of Thamnoid Hypna that appears to abound on the Quitinian Andes.

H. Whippleanum (sp. nov.): dioicum pusillum cæspitans sordide virescens; caule filiformi bis terve diviso, divisionibus arcuato-prostratis pinnatis flagelliformi-attenuatis apice radiculosis; foliis erecto-patentibus caulinis deltoideo-ramulinis ovato-lanceolatis acuminatis minute quadrate oblonge areolatis opacis dorso papillosis toto ambitu dentato-serratis, costa pellucida fere ad apicem attingente; perichætialibus filiformi-acuminatis evanidi-costatis; capsula abrupte horizontali, ovali oblongave, subinæquali, collo conspicuo instructa; peristomii albidi dentibus lineali-lanceolatis crebre articulatis, ciliis carina solutis, ciliolis binatis, omnibus æquilongis; operculo conico in medio constricto; pedicello tuberculato cauligeno. Habitat same as the last. A small species with thread-like stems 1–2 inches long; branches of the same thickness as the stems, 3–5 lines long, numerous and pinnately disposed. Pedicels 5–7 lines in height, cygneus. Perichaetia rooting at the base. Capsule dark chestnut brown, pachydermous; its junction with the pedicel being nearly at right angles: collum blackish, obtuse at base. Male flowers numerous on the main divisions of the stem, slightly stipitate; perigonial leaves broad-ovate long-acuminate ecostate; antheridia 10–15 copiously paraphysated.—(Plate IX.)

Hypnum crispifolium and Leskea laxifolia of Hooker, found on the northwest coast of this continent by Menzies, appear to be nearly related to this species; but from the description and figures of them, given by Hooker and Schwaegrichen, they are both larger plants than H. Wippleanum, particularly the first, which has subfalcate-secund, flexuous leaves much longer acuminated, and when dry crisped: the second has an ovate-globose capsule, a Leskeoid peristome, and leaves of a different areolation.

H. calyptratum, (sp. nov.) monoicum exiguum; caule filiformi repente subsimplici pinnato apice flagelliformi foliis erecto-patentibus late ovatis longe tenuiter acuminatis denticulatis inferne margine recurvis continuo-costatis dorso parce papillosis e cellulis minutis subquadratis dense areolatis; perichætialibus pellucidis striatis lanceolatis filiformi-acuminatis, costa excurrente; capsula cylindracea obliqua curvula exannulata; perist. dentibus lineali-acuminatis, ciliis linearibus foraminulosis, ciliolis singulis brevissimis; operculo conico obtuso; calyptra permagna cuculliformi infra capsulam descendente; pedicello cauligeno gracili longiusculo: flore masculo globoso gemmiformi, perigonialibus orbiculari-ovatis apice tenui recurvo, antheridiis eparaphysatis. Near Los Angeles, on the ground. A very small species belonging to a group constituting the genus Thuiduim of the Bryologia Europæa of Bruch and Schimper. Its distinctive characters consist in its small size, simply pinnate ramification, narrow elongated, inclined

slightly, curved and exannulate capsule, conic operculum, slender pedicel and very long, narrow calyptra, descending below the capsule and embracing the pedicel. It resembles small forms of H. scitum, *Beauv.* and H. gracile, *Br. & Sch.*, but differs essentially from both in its calyptra and in not having an annulus.—(Plate X.)

H. NOTEROPHILUM, *Sulliv. et Lesqx. Musc. Bor.-Amer. exsiccat., n.* 348; *Sulliv. in Gray's Manuel of Bot., 2d ed., p.* 478. Margins of small streams.

H. SERPENS, *Linn.;* Amblystegium serpens, *Bryol. Europ. Amblyst. monogr., p.* 9, *t.* 3. Common.

H. RIPARIUM, *Linn.;* Amblystegium riparium, *Bryol. Europ. Amblyst. monogr., p.* 14, *t.* 8. Wet places, frequent.

H. ADUNCUM, *Hedw.; Bryol. Europ. Hyp. monogr., p.* 35, *t.* 24. Grows with the last.

H. MYOSUROIDES, *Linn.;* Isothecium myosuroides, *Brid.; Broyl. Europ. Isothec. monogr., p.* 7, *t.* 2. Near San Francisco, dry woods.

H. NUTTALLII, *Wils.; Bryol. Brit., pp.* 334 *and* 339; *Sulliv. and Lesqx. Musc. Bor.-Amer. exsiccat., n.* 338*b*. On decayed trees, south of San Francisco.

H. OREGANUM, *Sulliv. in Mem. Amer. Acad. of Arts and Sci., v. IV, n. ser., p.* 179; *Cryptogamia of the U. S. Expl. Expd., t. XIII, ined.* In woods, on the ground, mostly in damp localities.

The collection contains five or six other species of hypnum; but the specimens are too imperfect to admit of determination.

HEPATICÆ.

FEGATELLA CONICA, *Corda.; Nees. Hepat. Europ. IV, p.* 181; Conocephalus vulgaris, *Bischoff. de Hepat. in Nov. Act. Acad. Nat. Cur. XVII* 2, *p.* 1001, *t.* 69, *f.* 4. On wet rocks, and on the ground near springs.

FIMBRIARIA TENELLA, *Nees. Hepat. Europ. IV, p.* 271; *Bischoff. de Hepat., l. c. t.* 69, *f.* 11. On dry ground, in shady places.

REBOULIA HEMISPHÆRICA, *Raddi.; Bischoff. de Hepat., l. c. t.* 69, *f.* 1. Dry, shaded rocks.

DUVALIA TENERA, *Gottsche. in G. L. and N. Synop. Hepat., p.* 554; Marchantia tenera, *Hooker in Kunth. Synop. Plant., p.* 45. Moist earth.

ANTHOCEROS LÆVIS, *Linn.; G. L. and N. Synop. Hepat., p.* 586. Springy, gravelly places.

METZGERIA FURCATA, *Nees.;* Jungermannia furcata, *Linn.; Hook. Brit. Junger., t.* 56. Damp, mossy rocks.

FOSSOMBRONIA PUSILLA, *Nees.;* Jungermannia pusilla, *Hook. Brit. Junger., t.* 69. Damp earth, frequent.

EXPLANATION OF THE PLATES.

PLATE I.—*Fissidens limbatus.*

Fig. 1, plants of the *natural size;* 2, 2, plants ; 3, 3, stem leaves ; 4, 5, base and apex of stem leaves, showing the areolation ; 6, cross sections of stem leaf ; 7, capsules ; 8, portion of capsule, with the peristome viewed from without ; 9, the same viewed from within ; 10, portion of capsule wall, showing the areolation ; 11, a tooth of the peristome ; *all magnified,* except fig. 1.

PLATE I.—*Leptodon circinatus.*

Fig. 1, plant in a moist state ; 2, the same when dry, both of the *natural size ;* 3, portions of primary branch and of a branchlet, the former having sterile flowers in the axils of its leaves ; 4, leaf of a branchlet ; 5, 6, base and apex of a leaf showing the areolation ; 7, 7, cross sections of leaf ; 8, cells of the leaf ; 9, 9, paraphyllia ; 10, sterile flower ; 11, the same without perigonial leaves ; 12, perigonial leaves ; 13, antheridium with paraphysis ; *all enlarged,* except figs. 1 and 2.

PLATE II.—*Barbula bachyphylla.*

Fig. 1, a sterile and two fertile plants, *natural size;* 2, a fertile plant ; 3, upper portion of the sterile plant showing the terminal perigonium, with a portion of an innovation ; 4, a perichætium, with an innovation from its base ; 5, 5, leaves from upper part of the stem ; 6, leaf from lower part of stem ; 7, perichætial leaf ; 8, 9, base and apex of a stem leaf, showing the areolation ; 10, cross sections of a stem leaf ; 11, capsule, operculum, and calyptra ; 12, capsule and operculum ; 13, two peristomes ; 14, portions of peristome and annulus ; 15, portion of a tooth of the peristome ; 16, portion of the annulus ; 17, antheridia and paraphyses, perigonial leaves, excepting one, removed ; 18, antheridium, paraphysis, and perigonial leaf ; *all magnified,* except fig. 1.

PLATE III.—*Barbula semitorta.*

Fig. 1, plants of the *natural size;* 2, a plant ; 3, 3, 3, 3, 3, stem leaves ; 4, a perichætial leaf ; 5, 6, base and apex of stem leaf, showing the areolation ; 7, 7, cross sections of leaf ; 8, vaginula with archegonia paraphysis and a portion of the pedicel ; 9, archegonium and paraphysis ; 10, 10, capsules with opercula and calyptra ; 11, calyptra ; 12, 12, peristomes ; 13, portions of the peristome and annulus ; 14, 15, portions of the teeth of the peristome ; *all magnified,* except fig. 1.

PLATE IV.—*Grimmia Californica.*

Fig. 1, a sterile and three fertile plants, *natural size ;* 2, a fertile plant ; 3, apex of the stem bearing the perichætium vaginula, pedicel, capsule, operculum, and calyptra ; 4, capsule operculum, and calyptra ; 5, capsule and operculum ; 6, capsule ; 7, capsule and portion of the pedicel in a dry state ; 8, calyptra ; 9, portion of peristome with annulus, viewed from without ; 11, vertical section of the same ; 10, two teeth of the peristome with spores ; 12, perichætial leaf ; 13, 14, stem leaves ; 15, 17, base and apex of leaf showing the areolation ; 16, cells of the lower part of the leaf ; 18, apex of the leaf ; 19, cells of the upper part of the leaf ; 20, sterile flower ; 21, perigonial leaf ; 22, antheridium ; *all magnified,* except fig. 1. The var. fig. 1*b*. plant of the *natural size ;* 2*b*. a portion of the stem ; 3*b*. a leaf ; *both magnified.*

PLATE V.—*Bryum Bigelovii.*

Fig. 1, two fertile plants ; 2, a sterile plant, *all of the natural size ;* 3, a fertile plant ; 4, 4, stem leaves ; 5, 5, comal leaves ; 6, 7, base and apex of stem leaves, showing the areolation ; 8,

cells of the lower part of the leaf; 9, cells of the upper part of the leaf; 10, 10, 10, capsules; 11, operculum; 12, portion of the peristome; 13, vaginula; 14, sterile plant; 15, apex of the same, enclosing the sterile flower; 16, antheridium, paraphyses, and perigonial leaf; 17, 17, cross sections of stem leaf; *all magnified,* except figs. 1 and 2.

Figures 2 and 14 are inverted through a mistake of the engraver.

PLATE VI.—*Bryum Californicum.*

Fig. 1, plants of the *natural size;* 2, a single plant; 3, 3, stems and branches; 4, a branch; 5, 5, 5, 5, 5, leaves; 6, cross sections of leaf; 7, a leaf showing the areolation; 8, portions of peristome and annulus; 9, vertical section of the same; 10, 10, 10, capsules; *all magnified,* except fig. 1.

PLATE VII.—*Bryum Occidentale.*

Figs. 1, 1, fertile plants; 2, sterile plant, *all of the natural size;* 3, a fertile plant; 4, 4, 4, leaves; 5, base of leaf and portion of branch, showing their junction; 6, 6, cross sections of leaf; 7, 8, base and apex of leaf, showing the areolation; 9, cells of the lower part of the leaf; 10, cells of the upper part of the leaf; 11, portions of peristome and annulus, outside view; 12, vertical section of the same; 13, 13, capsules; 14, capsule when dry; 15, vaginula; 16, sterile plant; 17, sterile flower; 18, perigonial leaf, antheridium and paraphyses; 19, perigonial leaf; 20, antheridium and paraphyses; *all magnified,* except figs. 1 and 2.

PLATE VIII.—*Hpynum Bigelovii.*

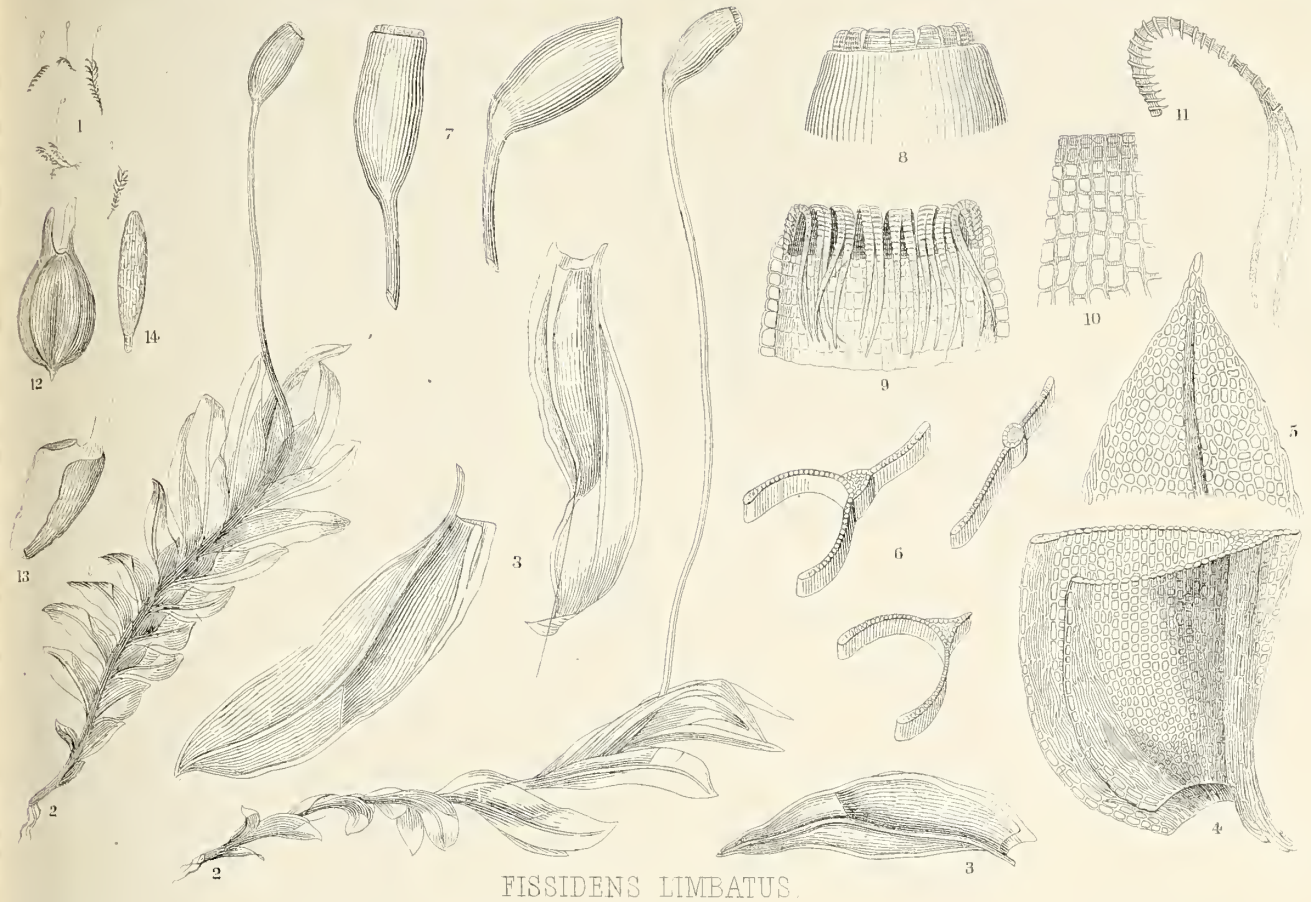
Figs. 1, 1, fertile plants; 2, sterile plant, all of the *natural size;* 3, fertile plant; 4, portion of a branch; 5, 5, 5, leaves; 6, apex of leaf showing the areolation; 7, cells of the same; 8, base of leaf showing the areolation; 9, cells of the same; 10, 11, 12, capsules, opercula, and calyptra; 13, portions of the peristome and annulus; 14, a tooth of the peristome, side view; 15, perichætium; 16, 16, perichætial leaves; 17, vaginula with archegonia and paraphyses; 18, sterile flower; 19, antheridium, paraphyses, and perigonial leaf; *all magnified,* except figs. 1 and 2.

PLATE IX.—*Hypnum Whippleanum.*

Eigs. 1, 1, 1, fertile plants; 2, sterile plant, all of the *natural size;* 3, fertile plant; 4, portion of sterile plant; 5, portion of a branch; 6, 6, 6, 6, stem and branch leaves; 7, 7, lower portion of leaves showing the areolation; 8, 8, upper portion of same, showing the areolation; 9, 9, 9, 9, 9, capsules; 10, 10, opercula; 11, portion of the peristome; 12, perichætium; 13, vaginula; 14, 15, perichætial leaves; 16, portion of the pedicel; 17, sterile flower; 18, antheridium and paraphyses; 19, perigonial leaf; *all magnified,* except figs. 1 and 2.

PLATE X.—*Hypnum calyptratum.*

Figs. 1 ,1, 1, 1, plants of the *natural size;* 2, portion of a plant; 3, portions of a branch; 4, 4, leaves; 5, a leaf showing the areolation; 6, portion of same; 7, cross section of leaf; 8, perichætium; 9, perichætial leaves; 10, 10, capsules with operculums and calyptras; 11, capsule with operculum; 12, capsule; 13, calyptra; 14, portion of peristome; 15, sterile flower and perigonial leaves; 16, antheridium; *all magnified,* except fig. 1.



FISSIDENS LIMBATUS.

LEPTODON CIRCINATUS.

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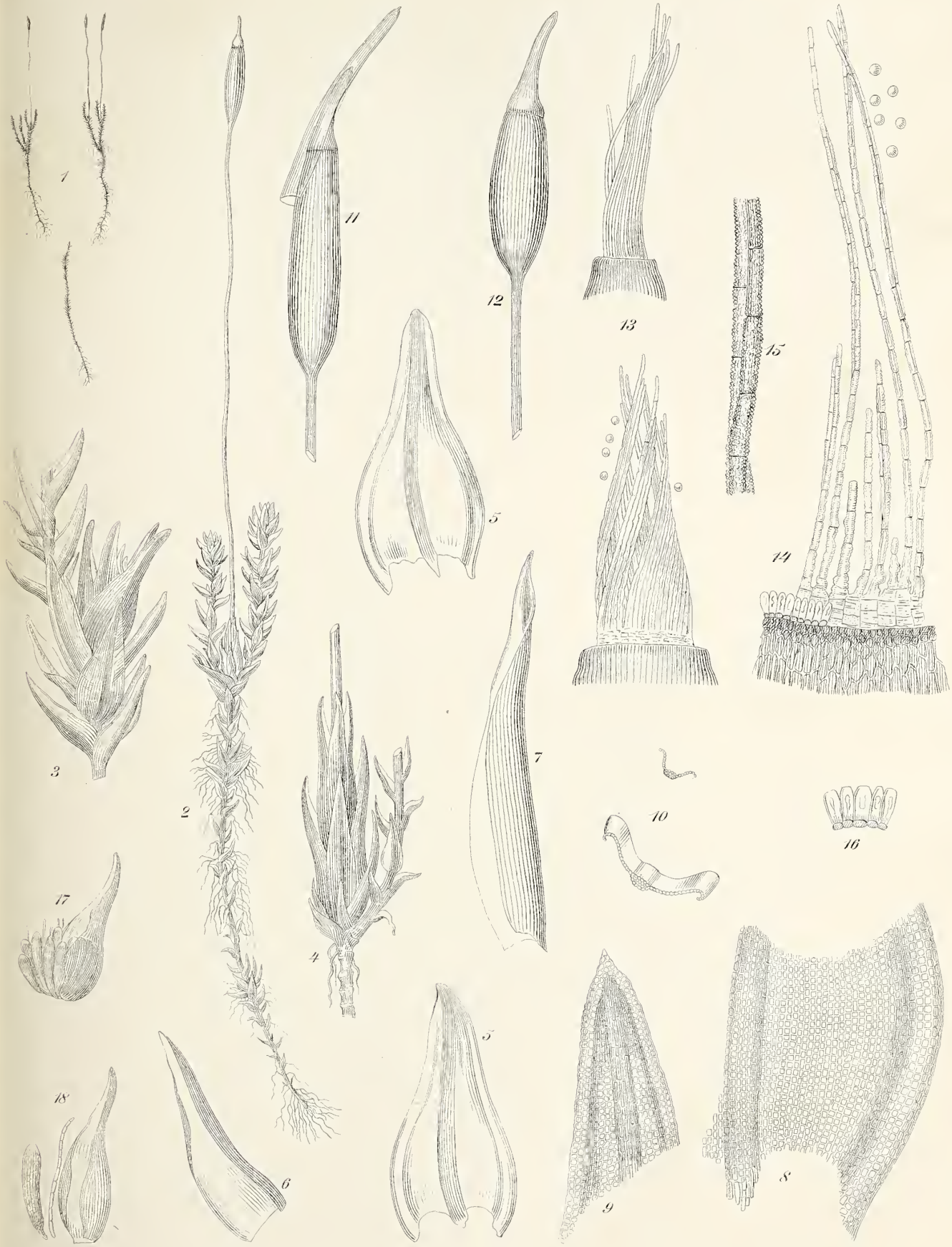
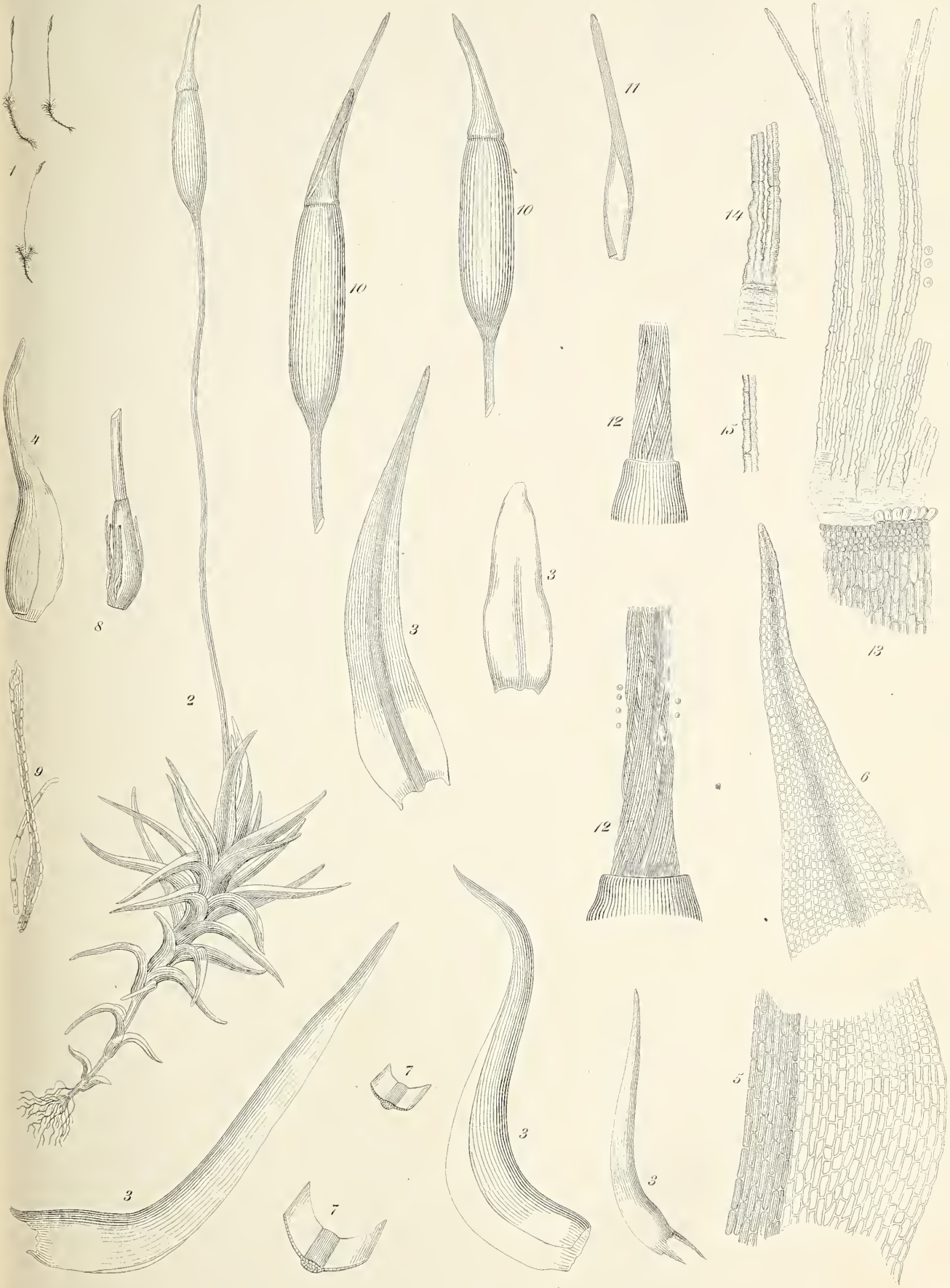


BARBULA BRACHYPHYLLA



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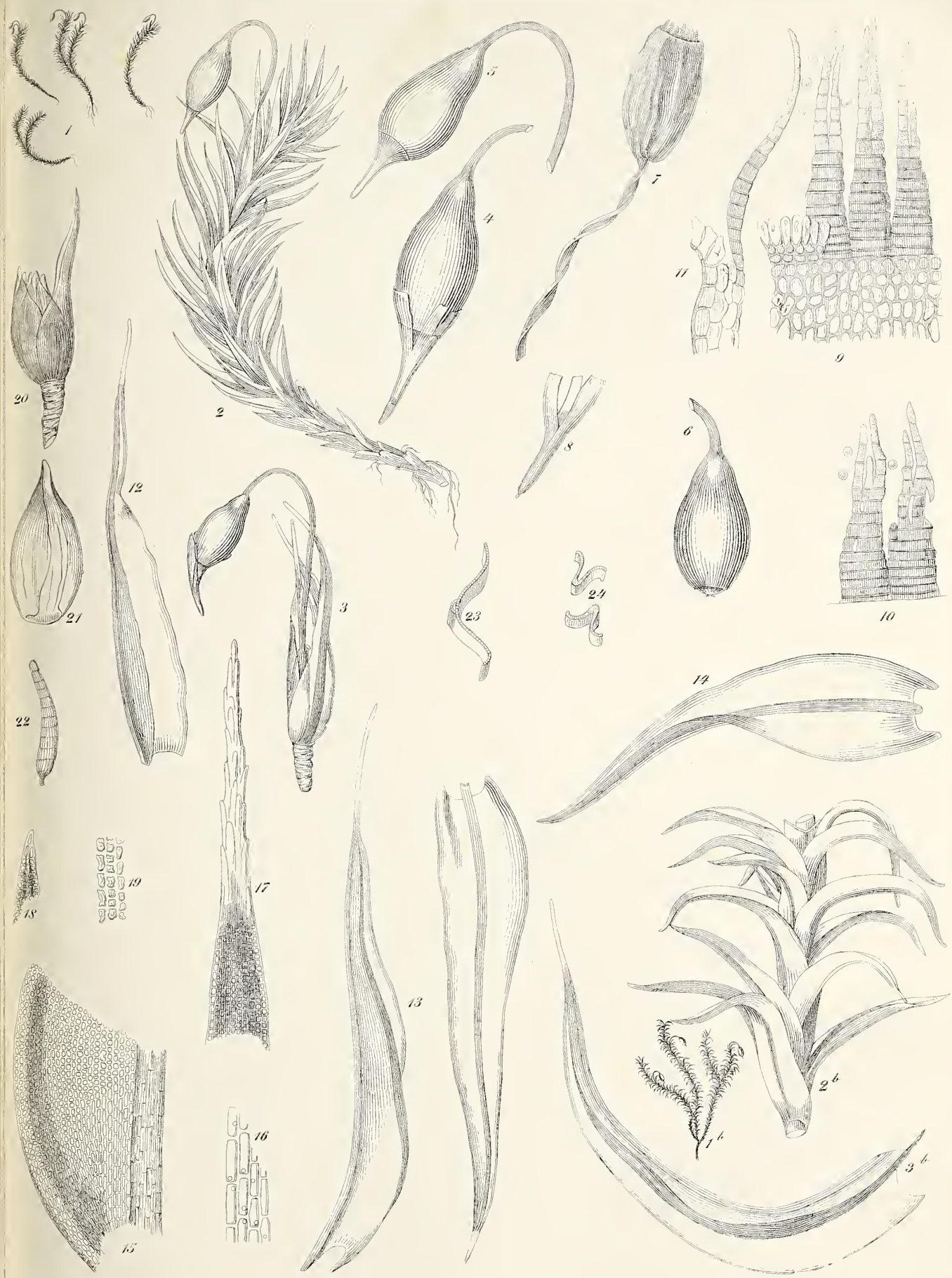

GRIMMIA CALIFORNICA.

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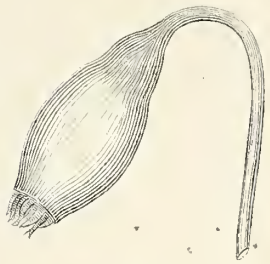
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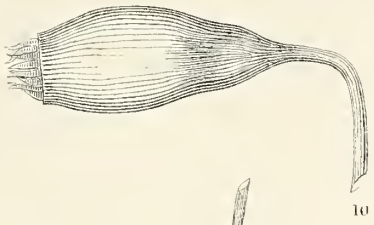
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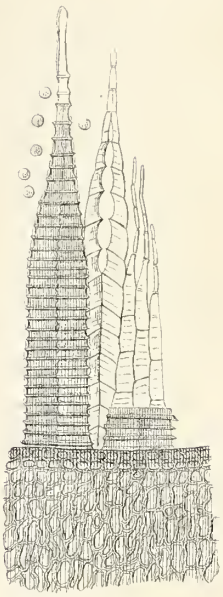
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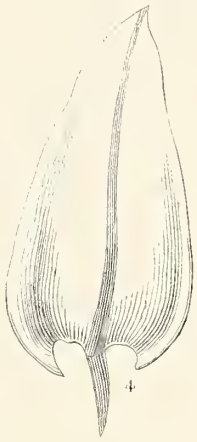
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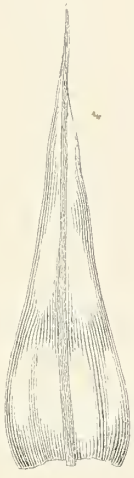
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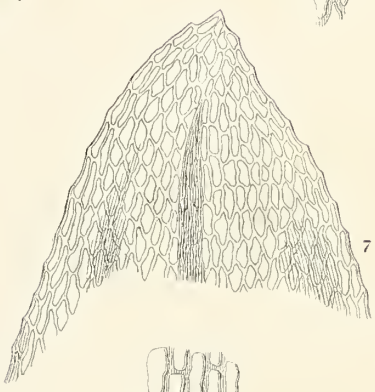
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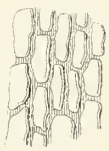
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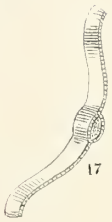
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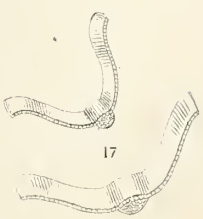
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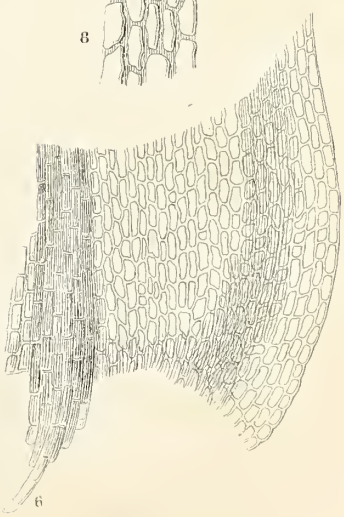
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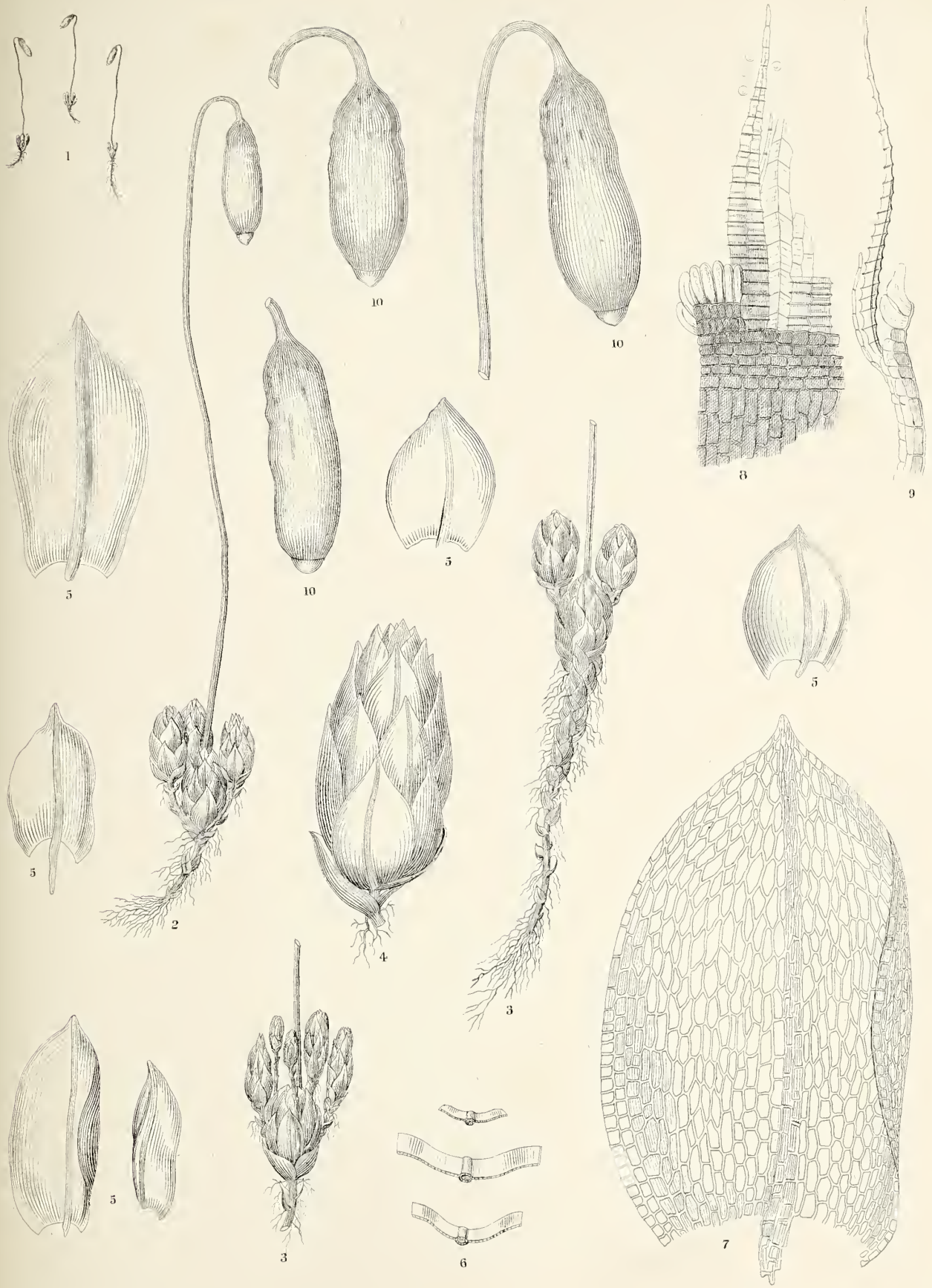
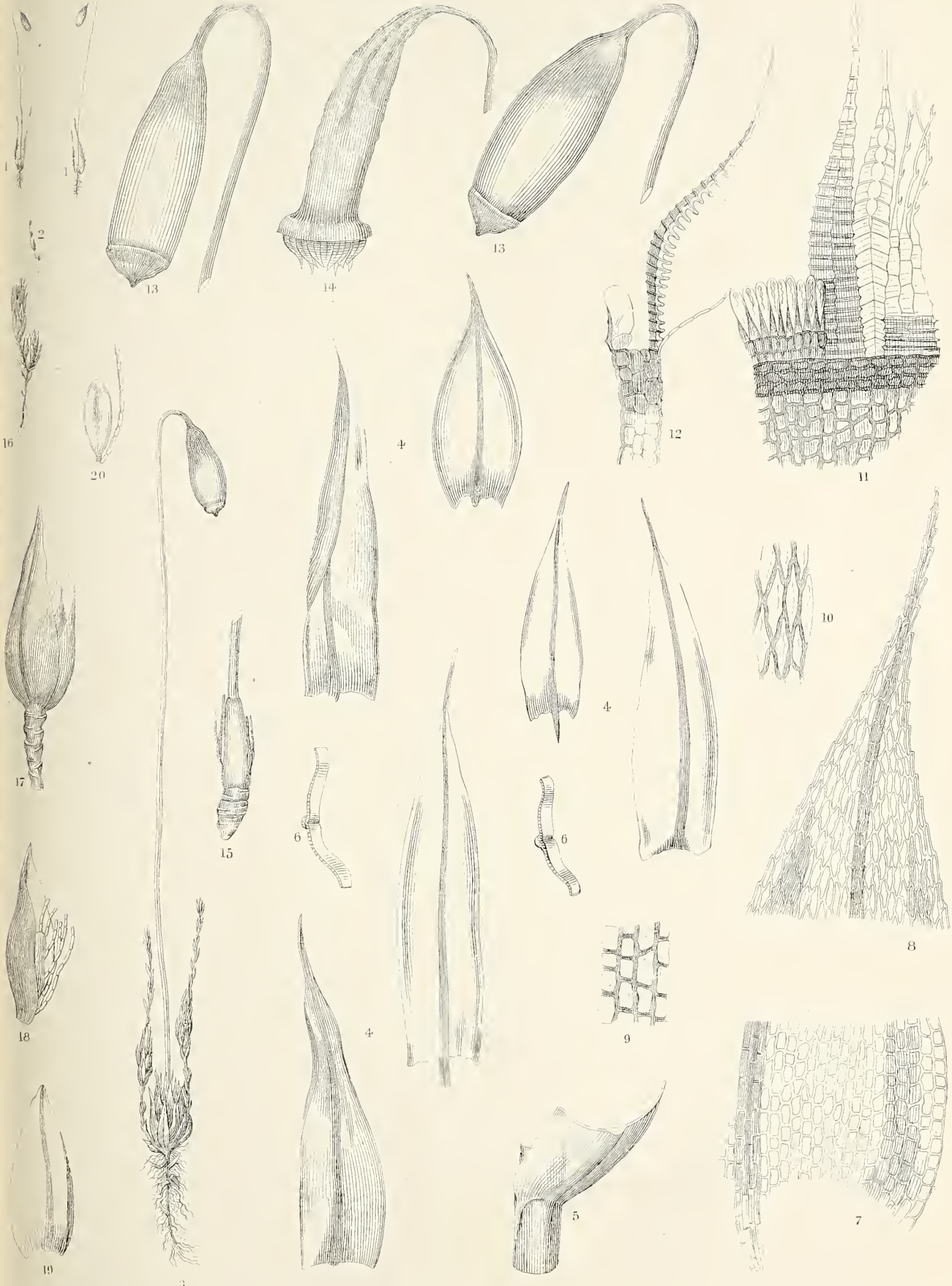
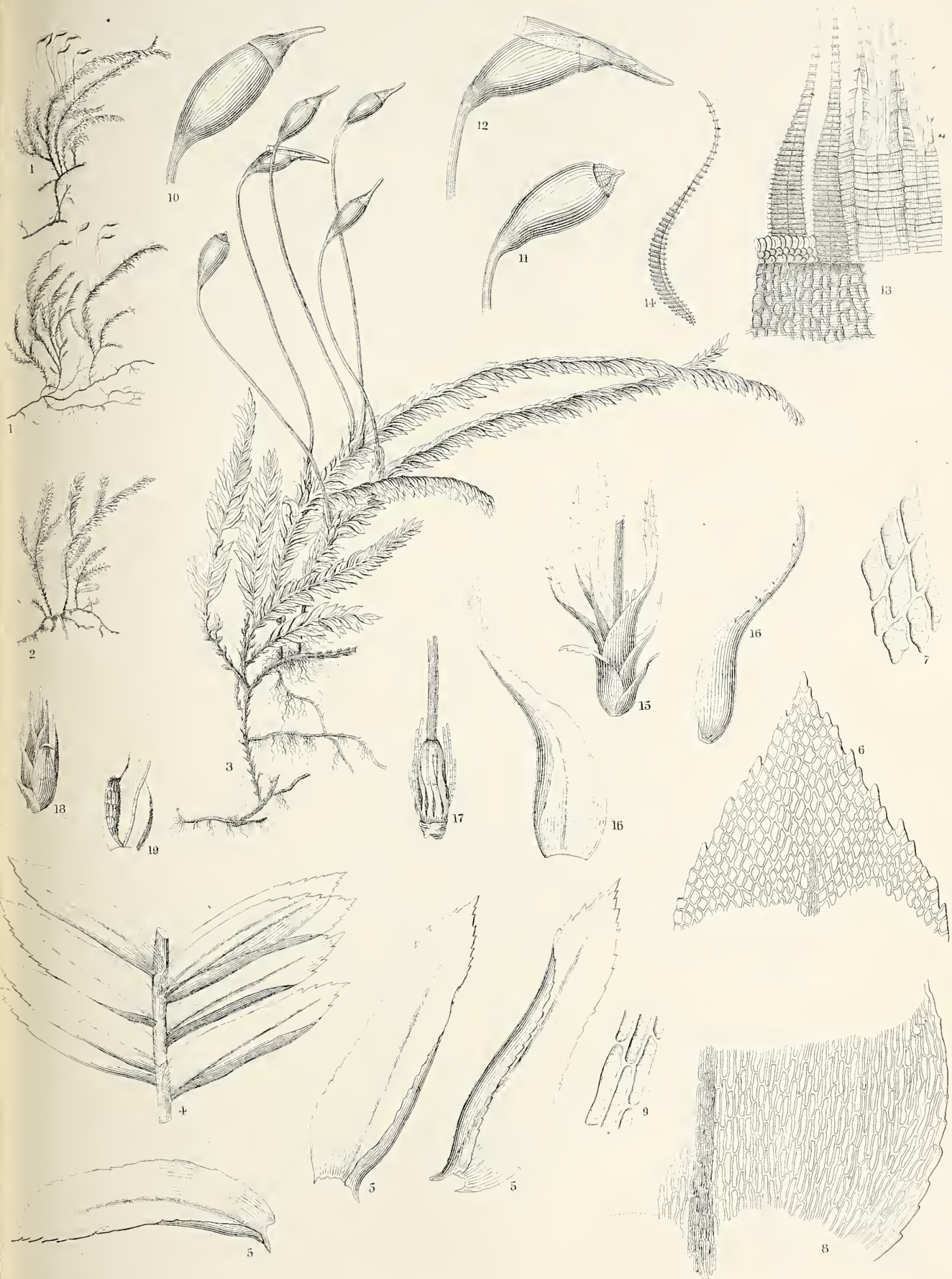


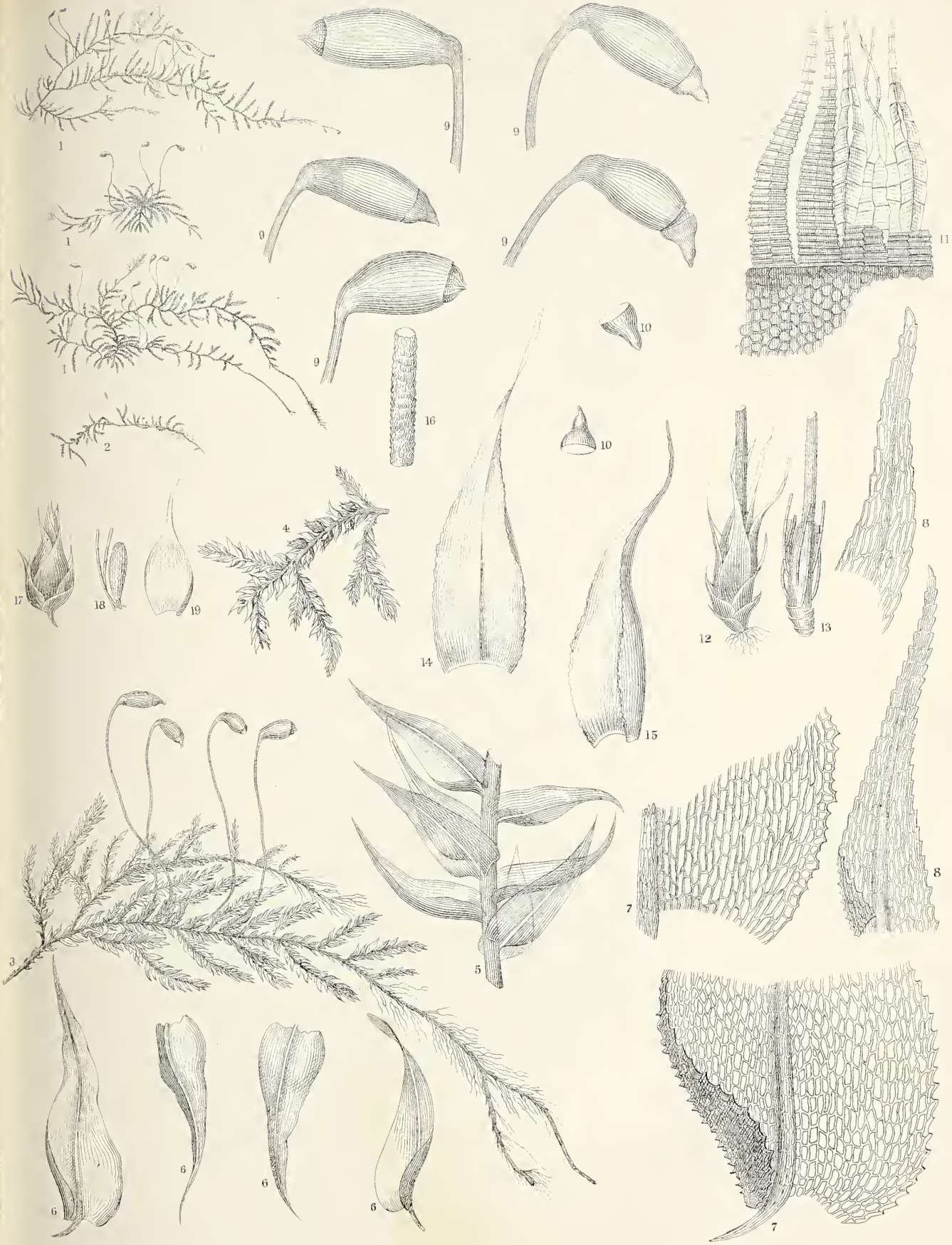
BRYUM CALIFORNICUM.



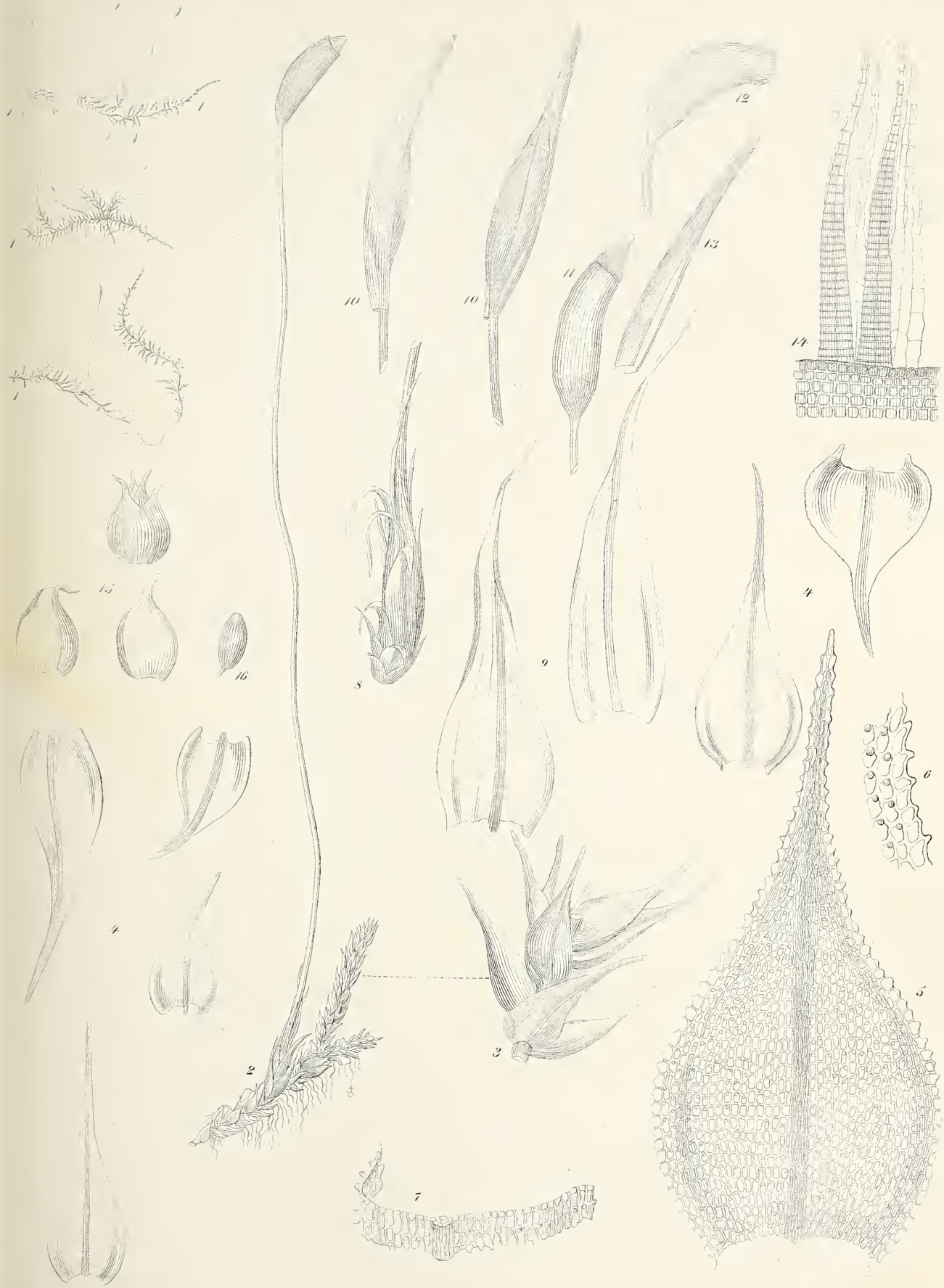
BRYUM OCCIDENTALE.



HYPNUM BIGELOVII.



HYPNUM WHIPPLEANUM.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PART VI.

EXPLORATIONS AND SURVEYS FOR A RAILROAD ROUTE FROM THE MISSISSIPPI RIVER TO THE PACIFIC OCEAN.

WAR DEPARTMENT.

ROUTE NEAR THE THIRTY-FIFTH PARALLEL, EXPLORED BY LIEUT. A. W. WHIPPLE, TOPOGRAPHICAL ENGINEERS, IN 1853 AND 1854.

REPORT

ON

THE ZOOLOGY OF THE EXPEDITION.

WASHINGTON, D. C.
1856.

No. 1.

FIELD NOTES AND EXPLANATIONS.

BY C. B. R. KENNERLY, M. D.,

PHYSICIAN AND NATURALIST TO THE EXPEDITION.

WASHINGTON, D. C., *July* 1, 1854.

SIR: I have the honor herewith to present a general account of the game animals of the country traversed by you in surveying a route for the railroad to the Pacific. I do not propose here to go into much detail, as the description of the individual species, with an account of their characteristic habits, is reserved for a subsequent report. For convenience of reference, I shall divide the line into several portions, and express, as briefly as possible, the peculiar features in the economical zoology of each.

From the Rio Grande to Zuñi.—Although this district is hunted very closely by Indians and other persons traversing it, yet in some places we found game abundant. Before reaching the pueblo of Laguna, however, animals of the larger kind were rarely observed, the country being for the most part quite open, and affording but little permanent water. Still, along the road, the large rabbit of this region (*Lepus callotis*) and the smaller species (*Lepus artemesiæ*) were found in considerable numbers; and, after reaching the Rio Rito, to these were added ducks and geese in great numbers. But after leaving this village, and approaching the Sierra Madre, we found ourselves in a country heavily wooded, and with an abundance of grass. Here we observed numerous herds of the black-tailed deer (*Cervus macrotis*) feeding in the little valleys; and, among the bushes on the hill-sides, several species of bears, the black (*Ursus Americanus*) and the huge grizzly, (*Ursus ferox.*) Among the trees in the mountain, the piñon (*Pinus edulis*) was very common, which affords a kind of nut on which the latter animals delight to feed, and it is not unpalatable even to man. This district has long been celebrated for its game, and the accounts that we heard proved not to be exaggerated.

Descending the western slope of the mountains, we again met with rabbits in great numbers. Besides these, we occasionally found the antelope; but being much hunted, they were here scarce and wild, and, when seen, were far off in small herds upon the plain. Along the valleys that stretch towards the pueblo of Zuñi, and which are generally hemmed in by rough and rugged hills, we found the grizzly bear (*Ursus ferox*) abundant. When impelled by hunger, they become very fierce, and, descending into the valleys, frighten off the *pastores*, who, in their terror, abandon their flocks to these huge monsters.

A part of this country abounds in birds of many varieties; among the lofty pines and thick cedars of the Sierra Madre, we were enabled to collect many valuable specimens of new and otherwise interesting species.

From the pueblo of Zuñi to the Little Colorado river.—Leaving the village, we continued our march for a short distance along the Zuñi creek, making, as we went, interesting collections of fishes, mostly new and undescribed species. Leaving the creek then to our left, we passed through a succession of cedar groves and grassy valleys, abounding in black-tailed deer and antelopes, (*Antilo capra Americana.*) In this region we first saw signs of the panther. This animal prefers the hill-sides or ravines, where the bushes are the thickest and most impenetrable, and rarely shows itself during the day on the open plain, unless forced there by hunger to hunt rabbits or other animals upon which it feeds. At night the prairie jackal, or coyote, (*Canis latrans*) rarely failed to approach our camp, and serenade us with his loud and varied notes. The long and dismal howl of the larger species (*Canis gigas*) was occasionally heard in the distance; but the latter is much less numerous than the former, and was not often seen. It, too, prefers the wooded regions, and depends mainly upon the deer for a subsistence, which it hunts, and rarely fails, after a long pursuit, in overtaking and conquering. In many places birds were scarce, yet we were enabled to collect some very interesting specimens. The weather being cold, the reptiles had all disappeared.

From Little Colorado to Pueblo creek.—Passing down the Little Colorado, we often saw ducks of the commoner kind—mallard and teal; but these were not so numerous as we expected. The cause may be found, perhaps, in the fact that along that portion of the valley over which we passed there were no marshes or flats, and the kinds of vegetable matter on which they feed were almost entirely wanting. Nor did the stream in that part furnish fish in great numbers; for, notwithstanding our frequent attempts to catch a few with our nets for specimens, we succeeded in taking only one. The beaver, (*Castor fiber,*) however, was very common in many places, as well as the Canada porcupine, (*Hystrix canadensis.*) They find a bountiful subsistence in the bark and tender twigs and buds of the young cottonwood trees, (*Populus,*) which grow luxuriantly in the sandy soil of the river bottom.

After leaving the Little Colorado, we turned directly towards the San Francisco mountain, its summit, at this season, (December,) covered with snow. Ascending the gravelly mesa, our train passed slowly on, occasionally turning from a direct line to avoid a small hill or little cañon. As we ascended, in approaching the mountain, we suffered not a little from the cold and piercing wind, from which there was no escape. The little valleys skirting its eastern base, supplying good grass, were now the resort of hundreds of antelopes, which were here also partly sheltered by the neighboring hills. This mountain is covered with a dense forest of pine, among which we found, in great numbers, the beautiful tufted squirrel, (*Sciurus aberti.*) This interesting animal we had not observed before; nor did we find it further west than this range. Wild turkeys were common, also, in the same locality. Ascending high into the mountains, we found many tracks of the big-horn, (*Ovis montana;*) but notwithstanding our repeated efforts to secure one, we were unsuccessful. The timidity of this animal causes it to dwell in the most inaccessible places.

A few short marches through dense pine forests and the deep snow brought us near Mount Sitgreaves, from the base of which stretched beautiful valleys, covered with grass, and dotted by clumps of cedars. This mountain had been, apparently, before the falling of the snow, the peculiar home of grizzly bears; but the cold and want of food had caused them all to go in search of other quarters. The number of trails of this animal that we found here, all leading towards the south, is almost incredible.

From this point our journey lay, for some days, along beautiful valleys, and often through thick and dark forests of cedars; and as we marched along we reaped a rich harvest of the smaller quadrupeds, such as pouched rats, mice, &c. Nor were we compelled to lay aside our rifles for want of larger game; for, although we saw no antelopes, the black-tailed deer was here quite common, and not very shy, being unaccustomed to the sight of man. Reaching soon a handsome valley, with its surface cut by a serpentine cañon—at some seasons, probably, containing a running stream, but now only watered by a succession of cool and clear pools—we

found, in great numbers, Gambel's partridge, (*Callipepla Gambellii.*) While encamped here this beautiful bird afforded us fine sport with our shot-guns, and furnished us with many delicious meals. Along this cañon were many deserted wigwams, the Indians having probably retired to the south at the approach of winter.

This immediate region being hilly, and covered, for the most part, by bushes, was not a spot well suited to the habits of the antelope, and hence we did not find it here. This species prefers the open valley, or wide and unbroken plain. Descending into the Chino valley, we found this animal in large herds, sometimes of hundreds. Occasionally, impelled by curiosity, they would approach quite near, and for a time gaze upon the train, then circling round, would hurry off and disappear in the distance. Indeed, the apparent curiosity of this animal is one of its marked peculiarities, and the western hunter often takes advantage of it to lure the unsuspecting creature within reach of his rifle.

After leaving the Chino valley, we entered again the cedar forests, where we found wild turkeys once more very abundant, frequenting, for the most part, the neighborhood of the little brooks that we found in this region, and feeding upon the berries of the rough-barked and other species of cedar.

In the thick underbrush along these creeks we often found the beds and resting places of the grizzly bear; but the animal itself we never saw. In this vicinity we caught some interesting fishes, and collected many handsome specimens of birds, the smaller species, particularly, being quite numerous.

From Pueblo creek to Williams' river.—Following up Pueblo creek nearly to its source in the mountains, we passed through Aztec Pass. This was a beautiful little stream, and we were sorry to leave it, as in this region one seldom sees such cool and limpid water.

Passing through the mountain, we again descended into a beautiful valley, where we found both the black-tailed deer and antelope quite numerous. Continuing our march, we crossed, from time to time, deep cañons with their pools of clear water, though containing no fishes, yet affording a sporting place for many ducks. The sides of these cañons are composed of rugged and precipitous cliffs, in which the lynx (*Lynx rufus*) and other wild animals of this region live. The caves, also, among these rocks often afford shelter for the wild Indians of this region, who gather the maguey plant, (*Agave Americana,*) which grows in great luxuriance here, and store it away for winter use. This is their principal food, although they combine with it the flesh of mice, rats, and such other animals as they can capture.

The distance from Pueblo creek to Williams' river is probably much less than the distance embraced between any other divisions that we have assumed; but it was a country throughout particularly rich in deer. It was a country, also, pretty well wooded with the various species of cedar, which, in addition to its affording a shelter for the larger animals, supplied also, in their berries, food for various species of the smaller birds, some interesting specimens of which we were enabled to collect. We frequently passed the burrows of the smaller quadrupeds, with their heaps of spiny cactaceæ piled over them to prevent the coyote from destroying them and their habitations. The long and barbed spines of this plant are sufficient to deter the wolf from committing his depredations, but the small rabbit, (*Lepus artemesiæ,*) not resorting to this important expedient for protection, often falls a victim to the rapacity of this animal by being chased or scented to its burrow and then dug out. The jackass rabbit, (*Lepus callotis,*) being much more swift than the small one, is less liable to be overtaken by its untiring enemy.

From Williams' river to the Great Colorado river.—We entered here upon a district of new character and of much interest. Descending into the valley of this stream, and travelling along its banks to its confluence with Rio Santa Maria, we had an opportunity of seeing, as well as collecting, many new and interesting objects; among the larger game recognizing many old acquaintances whose forms had now become familiar. On the wide mesas that stretched out on either side of us herds of antelope continually sported, and in the valley black-tailed deer were

not uncommon. In the precipitous and rugged mountains that we encountered we found the big-horn more numerous than in any other locality that we passed.

Following down Williams' river, with these interesting animals still for our companions, we continued our march towards the great river of the west. The beautiful stream sometimes emerged suddenly from the earth a bold rivulet, leaping playfully over its gravelly bed for several miles, and then would as suddenly disappear again beneath the sand. Whether creeping slowly among the bushes or passing through the open valley, we ever found something to please and interest us. The birds, however, of this region were particularly interesting. Myriads of ducks and geese were continually frightened from the stream or neighboring lagoons, of which a large number of interesting specimens were added to our collection. Among the smaller birds, which were also very numerous, we found several new and exceedingly interesting ones. At no other locality did we meet with such great success in collecting new and undescribed species, not only of birds, but also of reptiles and fishes. In this stream we found great numbers of the latter, comprising a variety of species not before observed.

From the Great Colorado river to the Pacific.—Travelling up the Colorado for some distance, we found its shores peopled by hundreds of Indians, whose friendly manifestations made us soon feel quite at home among them. Besides assisting us in many other ways, they also enabled us to procure some species both of fishes and birds, which, without their aid, we probably could not have captured. Thus our stay among them was made both pleasant and profitable. The birds and fishes constitute the most important features of natural history immediately in the vicinity of our route. The larger animals, being closely hunted, were scarce.

Crossing the river and accompanied by several Mojave Indians as guides, we continued our march towards the Pacific. From this point we saw but little of interest before reaching the Mojave river. Grass being scarce, except in the vicinity of the few watering places, we had but few companions during our long and tiresome marches, save the raven, which hovered over our now fast failing mules, and added to our dreary feelings by his hoarse croaks. Occasionally, too, the jackass rabbit would spring from his hiding place among the stinking larrea and hurry off. Frequently we found this animal far away from any water known to our guides. Sometimes, also, while encamped in this less-favored region, the cayote, attracted by our camp fires, would approach and serenade us as he had done before.

Near the watering places on our route, we frequently saw signs of the big-horn and other animals, where, watched by the Indians when coming to slake their thirst, they had been killed. It was not until after we had reached the Mojave river, however, that we met with much success in collecting specimens. Here, in addition to the many small birds that were continually singing around us, and the numerous ducks that were scared from the marshes, we found the stream itself inhabited by several species of fishes. Many of these we added to our collection; as also of the reptiles which here abounded. Approaching the mountain, we once more found the black-tailed deer and grizzly bear; one feeding in the green valleys, the other among the pines on the rugged slopes.

From this point our route lay along the beautiful valley of the San Gabriel river. Here we found the green pastures dotted by flocks of sheep and herds of cattle. Game of the larger kind was, of course, scarce through this region, being closely hunted by the inhabitants; but we found birds here of almost every variety of plumage, and many quadrupeds of the smaller species. Many of these we added to our collection before reaching Los Angeles, where we ceased our labors for a while, and enjoyed those comforts of which we had been so long deprived.

We were agreeably disappointed in regard to the abundance and character of the game of the country traversed. It will be seen from the foregoing statement that we were almost continually within reach of deer, antelope, and hare. Still, it would not be safe to depend upon game for subsistence in passing over the line, especially in the case of a large party. As is well known, all the animals just mentioned are easily driven off from their usual range by frequent interruptions, and at all times a skilful hunter is required to capture them. The case is different with

the buffalo, whose presence in a certain region is more to be calculated upon, and when seen is more readily captured, affording at the same time a much larger amount of food to each head.

Before concluding, I have the honor to present to your notice a summary statement of the number and variety of the specimens of natural history collected by Mr. H. B. Möllhausen and myself, between the Rio Grande and the Pacific ocean. Besides the collection herein mentioned, two other very extensive ones were made: one by Mr. Möllhausen, between Fort Smith, Arkansas, and Albuquerque, New Mexico; the other by myself, between Indianola, Texas, and Albuquerque, New Mexico. These were sent from the latter place to Washington, where they arrived safely, after a delay of several months on the prairies between Santa Fé and Independence, and are now deposited in the Smithsonian Institution, (together with the one which is the subject of this report,) to the credit of the expedition, having been also assorted and properly labelled.

In the following statement, the numbers used correspond to those attached to the specimens, and where a note or remark is wanting, it may be an indication, generally, that one may be found in another place, where the species are discussed separately.

STATEMENT.

No. of Label.		Locality.
No. 1.	Anser hutchinsi	Rio Rito, N. M.
2.	Querquedula carolinensis	do. do.
3.	Querquedula carolinensis	do. do.
4.	Skull of an Indian	Laguna, N. M.
5.	Fishes	Rio Gallo, N. M.
6.	Lepus artemesiæ	Sierra Madre, N. M.
(a)	Spermophilus harrisii	Sierra Madre, N. M.

This beautiful and rare spermophile is found in considerable numbers at Cold Spring, near the summit of the Sierra Madre. In this vicinity there were vast piles of scoriacious volcanic rock, in which it lived. It was not very shy, but a specimen was procured with difficulty, from the fact that it was almost impossible to kill the animal so dead, without spoiling completely the skin, that it could not crawl into the rocks beyond our reach before overtaken. Its food in this locality consisted of acorns and *piñones*, the fruit of the *Pinus edulis*. We again observed this animal near camp 139, between the Great Colorado and Mojave rivers. Here we found it on the hill-sides in the most rocky and inaccessible spots, and exceedingly shy. A specimen was procured only by secreting myself in the vicinity of the hole into which it escaped, and patiently watching an hour or more for its appearance.

No. 7.	Fishes	Rio Piscado, N. M.
8.	Rana*	do. do.

In many places in this creek there was much grass and moss and large masses of confervae floating on its surface. In such spots we found very many frogs, apparently all of the same species, but believed to be undescribed. The weather was unusually cold for the season (November), and these animals being completely chilled and torpid, were easily caught. The Zuñi Indians look upon them as sacred objects, believing them to be the preservers of the springs and possessing the power of keeping the supply of water in dry seasons. Their vessels are ornamented with rude paintings of this animal, and they are said to hold a grand feast once a year in honor of it. So strenuously did they remonstrate when they observed us taking them that we desisted until an opportunity offered when there were no Indians present.

* This specimen and others that follow, not having their species named, were lost upon the passage across the isthmus, and hence their characteristics were undetermined.

Nos. 9, 10, 11, 12, 13. Fishes.....Zuñi river, N. M.

The Zuñi river is a small stream of pure, clear water, emptying into the Little Colorado. We took fishes from it at several different localities, and found among them at least four distinct species; two of which we recognized as the *Gila robusta* and *Gila gracilis*, the latter being by far the most numerous. The others were believed to be new to science.

No. 14. Spiza ciris.....75 miles west of Albuquerque, N. M.
15. Milvulus forficatus..... do. do. do.
(*a*) Sialia occidentalis..... do. do. do.
(*b*) Carpodacus cassinii (n. s.*)..... do. do. do.
16. Xanthornus affinis..... do. do. do.
(*a*) Carpodacus pileatus..... do. do. do.
17. Picicorous Columbianus.....95 do. do. do.
(*a*) Spiza ciris..... do. do. do.
18. Gymnokitta cyanocephala..... do. do. do.
19. Ptiliogonys townsendii..... do. do. do.
20. Cyanocitta macrolopha (n. s.).....100 do. do. do.
21. Agelaius phoeniceus..... do. do. do.
22. Cyanocitta macrolopha (n. s.)..... do. do. do.
23. Agelaius phoeniceus..... do. do. do.
24. Sitta carolinensis..... do. do. do.
25. Archibuteo lagopus..... do. do. do.
26. Otocoris chrysolaemus.....Near Zuñi, N. M.
27. Do. do. .... do. do.
28. Fish.....Little Colorado river, N. M.

Although we were encamped on this stream at several places for some days, and although we searched it thoroughly, we were obliged to content ourselves with a single specimen. The absence of fishes at these places may, probably, be accounted for to some extent by the character of the stream itself. Its waters were loaded with sand, which was carried rapidly along by the current; besides, it was generally shallow, and offered no quiet pools as resting places; nor was there any grass or weeds or bushes in it, but its bottom was a continuous quicksand. The specimen procured measured about three inches in length; general color, white and silvery, with very small scales, belonging to the sucker family, but its genus was unknown.

No. 29. Ptiliogonys townsendii.....Near Zuñi, N. M.
30. Struthus Oregonus..... do. do.
31. Mimus montanus..... do. do.
32. Geococcyx viaticus.....First camp on L. Colorado river, N. M.
33. Geococcyx viaticus.....Third camp do. do.
34. Pica hudsonica.....Fourth camp do. do.
35. Picus harrassii..... do. do. do.
36. Psaltria plumbea (n. s.).....Sixth camp do. do.
37. Querquedula Carolinensis..... do. do. do.
38. Falco polyagrus..... do. do. do
39. Spizella Canadensis..... do. do. do.
40. Psaltria plumbea (n. s.)..... do. do. do.
41. Psaltria plumbea (n. s.)..... do. do. do.
42. Spizella Canadensis..... do. do. do.
43. Sitta pygmaea.....San Francisco Mts., N. M.

* (N. S.) This indicates that the species is new to science.

44. Zonotrichia fallax.....Camp 97.
45. Callipepla gambeli.....Camp 97.
46. Bubo magellanicus.....Camp 98.
47. Certhia Americana.....Pueblo creek N. M.
48. Carpodacus pileatus..... do. do.
(*a.*) Sturnella neglecta..... do. do.
(*b.*) Sturnella neglecta..... do. do.
49. Pipilo Oregonus..... do. do.
50. Lophophanes wollweberi..... do. do.
(*a.*) Aguelaius gubernator..... do. do.
51. Aguelaius gubernator..... do. do.
52. Sialia occidentalis..... do. do.
(*a.*) Carpodacus Cassinii (n. s.)..... do. do.
53. Cyanocitta macrolopha (n. s.).....Camp 105.
(*a.*) Strigiceps uliginosus..... do.
54. Tinnunculus sparverius..... do.
55. Regulus calendula..... do.
56. Regulus calendula..... do.
57. Otus Americanus.....Camp 107.
58. Corvus splendens (?).....Camp 110.
59. Sialia occidentalis..... do.
60. Sialia occidentalis..... do.
61. Zonotrichia leucophrys.....Camp 111.
62. Zonotrichia leucophrys..... do.
63. Psaltria plumbea (n. s.)..... do.
64. Zonotrichia leucophrys..... do.
65. Zonotrichia leucophrys..... do.
66. Thryothorus Mexicanus.....Camp 112.
67. Culicivora plumbea (n. s.).....Williams' river, N. M.
68. Thryothorus obsoletus..... do. do.
69. Ptiliogonys nitens..... do. do.
70. Pipilo mesoleucus (n. s.)..... do. do.
71. Buteo swainsoni.....Camp 114, Williams' river, N. M.
72. Pipilo aberti..... do. do. do.
73. Corvus splendens (?).....Camp 115, do. do.
74. Chrysomitris psaltria.....Camp 116, do. do.
75. Regulus calendula..... do. do. do.
76. Chrysomitris psaltria..... do. do. do.
77. Querquedula Carolinensis..... do. do. do.
78. Chrysomitris psaltria..... do. do. do.
79. Selasphorus costae.....Camp 117, do. do.
80. Selasphorus costae..... do. do. do.
81. Charadrius vociferus..... do. do. do.
82. Sturnella neglecta..... do. do. do.
83. Mimus polyglottus..... do. do. do.
84. Scops ——.....Camp 118, do. do.
85. Querquedula Carolinensis..... do. do. do.
86. Carpodacus familiaris..... do. do. do.
87. Carpodacus familiaris..... do. do. do.
88. Tyrannula sayi..... do. do. do.
89. Clangula albeola.....Camp 119, do. do.

No. 90. Mimus montanus.....Camp 119, Williams' river, N. M.
91. Culicivora plumbea?..... do. do. do.
92. Pipilo aberti.....Camp 120, do. do.
93. Mimus montanus..... do. do. do.
94. Psaltria plumbea..... do. do. do.
95. Pipilo mesoleucus..... do. do. do.
96. Ptiliogonys nitens..... do. do. do.
97. Chrysomitris psaltria..... do. do. do.
(*a*.) Bubo magellanicus..... do. do. do.
98. Charadrius vociferus..... do. do. do.
99. Centurus uropygialis (n. s.)..... do. do. do.
100. Peucæa lincolnlii..... do. do. do.
101. Pipilo aberti..... do. do. do.
102. Lepus callotis?.....Camp 97, Little Colorado river, N. M.

This species was found in greater numbers at the above-mentioned locality than elsewhere on the route. The valley at this point was covered by tall and coarse grass which grew in bunches, varying in size from a foot in diameter at the base, to several feet or even yards; there being always between them a narrow and tortuous, but clean pathway. In this grass this hare was generally found; rarely going to the hills; and the roots and tender shoots seemed to afford it food.

No. 103. Hystrix Canadensis.....Little Colorado river, N. M.
105. Neotoma ——.....Little Colorado river, N. M.

These animals were numerous in many places in the valley of this river. They lived in the sand in very tortuous holes, and extending for many yrds, though rarely more than fifteen inches below the surface. The entrance to their abode was generally in a pile of earth heaped around the base of a mezquite bush, (*Algarobia*,) upon the roots of which it seemed to feed. So far as we noticed, they were entirely nocturnal in their habits. On several occasions we attempted to dig them out with spades, but were always forced, after hours of labor, to relinquish the task without having accomplished our purpose. The specimen procured had, during the night, gotten into an empty bucket, from which it could not get out, and was captured alive in the morning. The body measured about three and a half inches, and the tail the same; the hair was coarser and darker than that of some others of the same genus noticed.

No. 106 Arvicola.....Camp 94.
(*a*) Arvicola.....Camp 94.
(*b* Arvicola.....Camp 94.

These three specimens were caught at New Year Spring. Here was a luxuriant growth of gramma grass, (*Boutelerea*,) both in the valley and on the hill-sides. On the latter places were many loose fragments of volcanic rocks of various sizes scattered about, but not in such quantities as to materially interfere with the growth of the grass. In this locality the specimens were found. They built their nests under the stones, and constructed them of dry grass in a manner similar to those of the common meadow mouse, (*Arvicola riparius*,) and, like this animal, had also paths under the grass, diverging in every direction from its hole; and, indeed, its general appearance was very much like that animal, and seemed only to differ from it in size, the specimens being decidedly smaller.

No. 107. Neotoma?.....Camp 96.

This animal was found in a country covered by a growth of the rough-barked cedar, (*Juniperus pachydermata*.) They seem to select a hollow tree with a hole near the root; then around it they pile vast heaps of dry twigs, and fragments of

the several species of cactaceæ (*Opuntia*) which grow here. The latter is probably a protection against the depredations of wolves. Numerous lodges of this kind were found throughout the forest, into one of which we dug until we reached the hole at the root of the tree; when, applying a match, we soon compelled the animal to leave it, which it did by finding its way out several feet above, and fell to the ground apparently dead. The food of this animal seems to consist mainly of the fruit of the cactus.

No. (*a*) ——— ———. (Mouse).....Camp 96.

This animal closely resembled the common field-mouse, (*Hesperomys*,) though somewhat larger; the ears, also, being somewhat larger in proportion to the size of the animal. Its abdomen was white, the same color extending slightly on each side; the feet perfectly white; the tail very long and hairy. It lived in the hollows of the cedar trees, like the subject of the preceding description, (107,) and also built up around the root of the tree a pile of small dry twigs. Sometimes as many as three were found living together in the same tree.

No. 108. Lepus artemesiæ.....Camp 99, Picacho mountains, New Mexico.
109. Hystrix Canadensis.....Little Colorado river, New Mexico.
110. Neotoma.....Camp 106.
111. Dipodomys ordii.....Camp 106.

In removing the cloth which was used in our tent as a carpet, this animal was found under it. No hole was observed in the ground within the tent, from which it could have come, nor did it attempt to make its escape into one; but when pursued, leaped wildly and rapidly about, making at each bound an astonishing distance. Its hind legs, being very long and muscular, are well adapted for this mode of locomotion.

No. 112. ——— ———. (Lizard).....Camp 110, New Mexico.
(*a*) ——— ———. (Lizard).....Camp 110, New Mexico.
113. ——— ———. (Lizard).....Camp 111, New Mexico.
(*a*) ——— ———. (Lizard).....Camp 111, New Mexico.
114. ——— ———. (Lizard).....Camp 111, New Mexico.
(*a*) Rana ———.....Camp 111, New Mexico.
115. ——— ———. (Lizard).....White Cliff creek, New Mexico.
(*a*) ——— ———. (Lizard).....White Cliff creek, New Mexico.
(*b*) Neotoma ——. White Cliff creek, New Mexico.

This was much the largest species of this genus that we saw. We found around a pile of rotten drift-wood near the creek, tracks and other evidences of the presence of some mammalia, and applying a match to the bushes, we patiently awaited the result; and when nearly the entire pile was consumed, the specimen came out, having four young ones adhering to it. The little ones were very young; and after the mother was killed, they were placed in an open spot on the sand, where they crawled awkwardly about for a while, uttering all the time a plaintive, whining cry, not unlike that of a very young kitten. They were caught early in February.

No. 116. Rana.....Camp 113, Williams' river, New Mexico.
117, 118, 134, 136, 141, 143, 144, 147. Fishes.....Williams' river, New Mexico.

The several lots of fishes enumerated above were taken at various times, at different localities, during our march down Bill Williams' fork. This stream frequently entirely disappears in the sand; but where it flows, is generally a bold and rapid rivulet of clear, pure water. The fishes which we took from it comprised at least five distinct species, and probably six or seven, among which were recognized the *Gila robusta* and *Gila elegans;* and of these two, the former species was the most abundant. The others were probably entirely new and undescribed.

No. 118 (*a.*) ——— ——— .....(Lizard)..... Williams' river.
(*b.*) Scolopendra ——— ..... Williams' river.
119. Spermophilus ——— .....Camp 117, Williams' river.

This animal was found among the rocks on the hill sides in the immediate vicinity of the creek. It was very active, and ran with great rapidity. It was somewhat larger than the *Spermophilus tridecem-lineatus;* its color a uniform rusty gray, its belly being of a lighter color. Its hair was rather coarse; its tail short and bushy. Two specimens were observed in this locality, one of which only was procured; but at no other locality on the route was another observed.

No. 119 (*a.*) Geomys ——— .....Camp 117, Williams' river, N. M.
120. ——— ——— (Lizard) .....Camp 119 do. do.
(*a.*) ——— ——— (Lizard) ..... do. do. do.
121. ——— ——— (Lizard) .....Camp 121 do. do.
(*a.*) ——— ——— (Snake)..... do. do. do.
122. Lepus callotis (?)..... do. do. do.
123. Bufo ———.....Camp 125 do. do.
(*a.*) Bufo ——— ..... do. do. do.

These toads were quite common at many points along this creek, and were generally found among the bushes or on sandy spots, though sometimes observed in the water. They were all small, the usual length of the body being about two inches, including the outstretched hindlegs about 3½ inches.

(*b.*) Perognathus ———.....Camp 125, Williams' river, N. M.

This was an extremely rare animal. The specimen procured was probably *Perognathus flavus*, at least in size and general appearance it very closely resembled it.

124. Phrynosoma ———.....Camp 128, Great Colorado river.
(*a.*) Do. ——— ..... do. do. do.
(*b.*) Do. ——— ..... do. do. do.
(*c.*) Do. ——— ..... do. do. do.
(*d.*) Gila elegans..... do. do. do.
(*e.*) ——— ——— (Lizard.)..... do. do. do.
125. ——— ——— (Rat.)..... do. do. do.
(*a.*) Crotaphytus ——— .... do. do. do.

This large lizard was found on the side of the mountain, and when observed was stretched out on a rock, apparently enjoying the heat of the sun. While in this position it was approached by an Indian and shot with an arrow. Although it was the only specimen seen, we learned from the Pah-Utahs that it was not an uncommon animal in this locality, and was prized by them as an article of food.

No. 126. ——— ——— (Lizard.).....Camp 131.
(*a.*) ——— ——— (Lizard.)..... do.
(*b.*) Phrynosoma ——— ..... do.
(*c.*) Do. ——— ..... do.
127. ——— ——— (Rat.)..... do.
128. ——— ——— (Lizard.).....Camp 133.
(*a.*) ——— ——— (Lizard.)..... do.
(*b.*) ——— ——— (Lizard.)..... do.
129. Phrynosoma ———.....Camp 144.
(*a.*) Do. ——— ..... do.
(*b.*) Crotalus ——— ..... do.
130. Phrynosoma ———.....Camp 147, Mojave river, Cal.
(*a.*) Do. ——— ..... do. do.

(*b.*) Hesperomys ——— .....Camp 147, Mojave river, Cal.
131. ——— ——— (Snake.).....Camp 149, do.
132. Fishes.....Camp 146, do.

This stream rises in the coast range of mountains, and flows towards the Great Colorado, but probably sinks in the sand long before reaching that river, Where we saw it, it was a bold rivulet of clear and pure water. The lot of fishes taken from it comprised about three species, probably all new to science.

No 133. Fishes .....Great Colorado river.

We did not observe more than two species of fishes in this stream, one of which was the *Gila elegans*, the other unknown.

No. 135. Fishes .....Pueblo creek, New Mexico.

This was the most beautiful mountain stream that we observed on our journey. Its pure and clear water came tumbling and bubbling over the rocks in such a manner as to forcibly remind us of the mountain brooks of the Atlantic States. It probably empties into the San Francisco river. From it we obtained a single species of fish, the largest specimen not being more than 2 or $2\frac{1}{2}$ inches in length.

No. 137. ——— ———. (Lizard).....Cajon Pass, California.
138. Hesperomys ———. .....Williams' river, New Mexico.
(*a.*) Hesperomys ———. .....Williams' river, New Mexico.
139. ——— ———. (Snake).....Great Colorado river.
(*a.*) Hesperomys ———. .....Great Colorado river.
140. Neotoma ———. .....San Francisco mountains, New Mexico.
142. Rana ———. .....Camp 134, Williams' river, New Mexico.
(*a.*) ——— ———. (Shells).....Camp 134, Williams' river, New Mexico.
145. Neotoma ———. .....San Francisco mountains, New Mexico.
146. Neotoma ———. .....Camp 90.
148. Scorpio ———. .....Williams' river.
151. Crotalophorus ———. .....Little Colorado river.
152. Rana ———. .....White Cliff creek, New Mexico.
(*a.*) Rana ———. .....White Cliff creek, New Mexico.

This tributary of Williams' river is a stream of clear and pure water, and the frogs here obtained are probably identical with those obtained from that stream.

No. 153. Hesperomys ———. .....Head waters of Williams' river.
(*a.*) Hesperomys ———. .....Head waters of Williams' river.
154. Neotoma ———. .....Great Colorado river.
155. Geomys fulvus.....Camp 99, Picacho mountains, New Mexico.
156. Sciurus aberti .....San Francisco mountains, New Mexico.
(*a.*) Sciurus aberti .....San Francisco mountains, New Mexico.
(*b.*) Sciurus aberti .....San Francisco mountains, New Mexico.

This beautiful squirrel was very common in the San Francisco range of mountains, living among the tall pines that here abound, and finding its chief subsistence in the *piñones*, the fruit of the *Pinus edulis*. We did not observe it farther west than Mount Sitgreaves.

No. 157. Spermophilus beecheyii.....Cocomongo Rancho, California.
(*a.*) Spermophilus beecheyii.....Cocomongo Rancho, California.
(*b.*) Spermophilus beecheyii.....Cocomongo Rancho, California.

These singular animals are very numerous near the Cocomongo Rancho, and, indeed, throughout the valley of the San Gabriel river. They were always found living in communities, and in their habits, generally, very closely resembled the prairie dog, (*Cynomys ludovicianus.*) Their size is about that of the common grey squirrel, (*Sciurus carolinensis,*) or perhaps a little larger. Their color is usually a

rustyish gray, and varying from that to very dark; I have seen some specimens almost black. The owl, (*Athene hypogæa*,) which is the constant companion of the prairie dog, was also found among these animals in considerable numbers.

No. 158. Mephitis ———. .....Camp 104, Pueblo creek, New Mexico.

This skunk was intermediate in size between the common *Mephitis chinga* and the *Mephitis zorilla* of Mexico. Its general color was black, with a white line on each side, white forehead, and the tip of the tail white. It was the only specimen observed.

No. 159. Skull of a Navajo Indian.....Fort Defiance, New Mexico.
160. Human skull.....Found on Williams' river, New Mexico.
161. Ovis montana, (skull of female).. .... do. do. do.
162. Canis latrans, (skin) ..... do. do. do.
163. Antilocapra Americana, (skin).....San Francisco mountains, New Mexico.
164. Ovis aries, (skull).....New Mexico.

This specimen was procured on account of its peculiarity in having four horns, that are well developed, being about eight inches in length; one on each side erect, and one turned downwards. It is said that, many years ago, the proprietor of an extensive hacienda on the Rio Grande owned a vast number of sheep possessing this peculiarity, and that the number of horns to each individual was never less than three, and often as many as seven. His flock was driven off by the Navajo Indians, who still graze large numbers of these animals in the mountains of New Mexico, and among which exist many anomalies of this kind.

No. 165. Picus scalaris .....Camp 122.
166. Pterocyanea cæruleata .....Camp 123.
167. Scolopax Wilsonii..... do.
168. Scolopax Wilsonii..... do.
169. Cypselus melanoleucus, (n. s.). ..... do.
170. Tyrannula sayi..... do.
171. Centurus uropygialis, (n. s.)..... do.
172. Dafila acuta .....Camp 126.
173. Sturnella neglecta..... do.
174. Spizella pallida .....Camp 127.
175. Coturniculus passerinus..... do.
176. Cotyle serripennis..... .....Camp 128.
177. Antrostomus nuttalli.....Camp 130.
178. Lanius ludovicianus..... do.
179. Morphnus unicinctus .....Camp 134.
180. Colaptes rubricatus?..... do.
182. Pterocyanea cæruleata .....Mojave river, California.
183. Callipepla Californica ..... do. do.
184. Totanus melanoleucus..... do. do.
185. Buteo montanus..... do. do.
186. Cyanocitta Californica..... do. do.
187. Agelaius gubernator.....Cocomongo Rancho, California.
188. Agelaius gubernator..... do. do.
189. Tyrannula nigricans..... do. do.
190. Sylvicola Audubonii..... do. do.
191. Athene hypogæa.....Los Angeles, California.
192. Aix sponsa.....San Francisco, California.
193. Chaulelasmus streperus..... do. do.
194. Fuligula mariloides..... ..... do. do.

195. Numenius longirostris.....San Francisco, California.
196. Rallus elegans..... do. do.
(*a.*) Ibis ordii..... do. do.
197. Ovis montana.....(skull of male).....San Francisco mountains, New Mexico.
198. Canis latrans.....(skull).....Williams' river, New Mexico.

A single glance at the foregoing statement is sufficient to convince us that the collection was a very extensive one, and possessed of rare interest. The country traversed by the expedition was almost entirely unexplored, and afforded an opportunity for scientific research but seldom offered; and we strenuously endeavored to make as complete a zoological collection as we could, by procuring and preserving everything within our reach; and after reaching Los Angeles, in looking over the specimens, and finding among them so many things new to science, felt ourselves fully and richly rewarded for any trouble or labor that we may have undergone in obtaining them. At that place nearly the entire alcoholic collection, for convenience of transportation, was repacked and placed in a large keg. And it becomes my painful duty to report, that this keg, containing, as it did, many of our most valuable specimens, was lost at Panama, through the negligence of Hinckley's Express Company, to the agent of which it was turned over for transportation to Aspinwall; and, notwithstanding our efforts to recover it have been unceasing up to the present time, we have been entirely unsuccessful; nor have we even been able to elicit any information concerning it. It contained the specimens corresponding to the following numbers, viz: 5, 6, (*a*,) 7, 8, 9, 10, 11, 12, 13, 28, 102, 105, 106, (*a*,) (*b*,) 107, (*a*,) 108, 110, 111, 112, (*a*,) 113, (*a*,) 114, (*a*,) 115, (*a*,) (*b*,) 124, (*a*,) (*b*,) (*c*,) (*d*,) (*e*,) 125, (*a*,) 126, (*a*,) (*b*,) (*c*,) 127, 128, (*a*,) (*b*,) (*c*,) 129, (*a*,) (*b*,) 130, (*a*,) (*b*,) 131, 132, 133, 134, 135, 136, 137, 138, (*a*,) 139, (*a*,) 140, 141, 142, (*a*,) (*b*,) 143, 144, 145, 146, 147, 148, 149, I51, 152, (*a*,) 153, (*a*,) 154, 155, 156, (*a*,) (*b*,) 157, (*a*,) (*b*,) 158. It will be perceived from the foregoing that, through this negligence, not only the expedition has suffered very seriously, but that science itself has met with an almost irreparable loss; which, we are sure, no one will regret more earnestly than yourself, knowing, as we do, the lively interest that you have always manifested in this department, and your untiring efforts to promote its success.

In conclusion, allow me to state that, in making collections in natural history, I was very kindly and continually assisted by Mr. Möllhausen, to whose zeal and industry equal credit with myself is due for the number and variety of specimens.

Very respectfully, your obedient servant,

C. B. R. KENNERLY, M. D.,
Physician and Naturalist to the Expedition.

A. W. WHIPPLE,
First Lieut. Topographical Engineers, U. S. A.,
In charge of exploration for railroad route near 35th parallel.

NOTE.

The remainder of the Zoological Report will appear in a subsequent volume, it being impossible to prepare it in time for publication in connexion with the other portions of this report.

APPENDICES TO REPORT.

APPENDIX A.

ASTRONOMICAL OBSERVATIONS WITH SEXTANT.

SEXTANT NO. 1 AND ARTIFICIAL HORIZON OF MERCURY.

FORT SMITH, (*Rogers' Hotel*)—JULY 5, 1853.

Object observed.	Time of observ'n by chronometer.	Observed double altitude.
	h. *m.* *s.*	° ′ ″
α Lyræ	5 08 11.6	107 47 50
	5 11 53.8	109 14 00
	5 14 28.1	110 14 40
	5 16 08.0	110 50 50
	5 16 58.9	111 11 00
	5 18 40.0	111 49 20
	5 20 09.9	112 24 50
Arcturus	5 23 06.0	127 50 50
	5 25 25.8	126 58 40
	5 26 46.2	126 32 00
	5 59 58.8	114 08 50
	6 01 28.6	113 33 20
Polaris	5 31 55.9	68 41 20
	5 34 50.1	68 42 10
	5 36 13.9	68 44 00
	5 38 20.2	68 44 20
	5 47 09.9	68 48 40
	5 52 38.2	68 51 00
	5 53 47.5	68 51 50

Thermometer 80°. Barometer 29.7 in. Index error — 50″.

CAMP WILSON—JULY 6, 1853.

α Lyræ	5 25 32.6	114 29 00
	5 27 56.5	115 24 10
	5 29 23.3	115 59 10
	5 30 38.2	116 27 10
	5 31 56.7	116 57 30 ?
Arcturus	5 45 28.2	119 39 45
	5 47 47.9	118 47 45
	5 49 18.2	118 13 50
	5 50 18.1	117 51 45
	5 53 14.6	116 44 10
Polaris	5 56 22.2	68 50 10
	5 57 48.6	68 50 20

CAMP WILSON—JULY 6, 1853—Continued.

Object observed.	Time of observ'n by chronometer.	Observed double altitude.
	h. *m.* *s.*	° ′ ″
Polaris	5 59 34.4	68 51 30
	6 01 33.9	68 53 00
	6 02 28.2	68 54 10

Thermometer 78°. Barometer 29.7 in. Index error — 50″.

SEXTANT No. 2.

CAMP WILSON—JULY 12, 1853.

Polaris	6 24 04.2	69 13 20
	6 25 06.6	69 14 50
	6 26 13.9	69 15 00
	6 27 02.0	69 15 30
	6 28 07.9	69 16 00
	6 29 02.2	69 16 20
	6 30 01.4	69 16 50
	6 31 30.1	69 18 20
	6 32 48.9	69 19 00
	6 34 15.1	69 20 10
	6 35 25.6	69 20 50
	6 36 29.9	69 21 30
α Cygni	6 40 32.5	97 31 30
	6 41 39.9	97 55 00
	6 43 01.9	98 24 10
	6 44 10.0	98 48 30
	6 45 19.2	99 13 10
	6 46 27.3	99 36 40
	6 47 51.2	100 06 10
Arcturus	6 51 13.8	94 06 20
	6 52 58.2	93 24 25
	6 53 52.6	93 02 00
	6 55 03.6	92 32 10
	6 55 42.9	92 17 10
	6 57 24.0	91 36 25
	6 58 54.9	91 00 00

Index error — 8′ 55″. Thermometer attached 78°. Thermometer detached 26°. Barometer 29.7 in.

NOTE.—It has been deemed proper to give the original unreduced records of the astronomical, magnetic, and meteorological observations, in order that those who have a special interest in these subjects may recompute any portion of the data upon which the results are founded. This is regarded as the more important, in consequence of the hasty manner in which the tables were prepared to be submitted to the department. The latitudes and longitudes were required at so early a period for the construction of the maps, that little time was allowed for the verification of the primary computations.

APPENDIX A—Continued.

CAMP WILSON—JULY 13, 1853.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Lyræ	5	28	49.5	115	44	00
	5	30	04.3	116	13	50
	5	31	27.1	116	44	50
	5	32	11.9	117	02	20
	5	33	05.8	117	23	20
	5	34	15.1	117	50	00
	5	34	55.9	118	05	50
Arcturus	6	10	24.2	110	21	10
	6	11	25.3	109	56	50
	6	12	11.5	109	38	20
	6	13	18.6	109	12	20
	6	14	11.3	108	52	00
Polaris	5	39	21.9	68	47	40
	5	40	12.2	68	48	00
	5	40	59.1	68	48	30
	5	42	06.5	68	49	10
	5	42	52.2	68	49	00
	5	44	03.9	68	50	20
	5	45	34.5	68	50	50
	5	46	18.0	68	51	00
α Scorpii	5	48	56.4	58	09	10
	5	50	06.2	57	08	50
	5	51	11.6?	57	10	50
	5	52	59.9	57	12	00
	5	54	16.0	57	12	00
	5	55	14.2	57	13	00
	5	56	25.6	57	13	20
	5	57	36.8	57	14	10
	5	58	30.0	57	13	30
	5	59	18.2	57	13	50
	6	00	13.1	57	14	00
	6	00	58.8	57	10	20
	6	02	03.5	57	13	40
	6	03	19.2	57	12	40
	6	04	29.4	57	11	50
	6	05	15.1	57	11	50
	6	06	11.2	57	11	40
	6	06	52.9	57	11	00
	6	07	41.0	57	09	30
	6	08	48.5	57	08	10
Moon's lower limb	6	26	45.5	56	31	50
Jupiter to moon's W. limb.	6	28	41.9	64	49	30
	6	30	16.0	52	07	50
	6	31	24.2	52	08	00
	6	32	22.3	52	07	50
	6	33	48.3	52	06	40
	6	35	28.5	52	06	00
	6	36	34.7	52	05	10
	6	37	14.5	52	04	50
	6	38	03.8	52	04	40
	6	39	03.9	52	03	50
	6	35	44.0	52	03	00
Jupiter	6	37	03.4	64	52	30
Moon	6	38	45.6	50	39	20

Index error — 9′ 30″. Barometer, 29.618 in. Thermometer detached, 78°.2.

CAMP No. 1, (*Ring's Plantation.*)—JULY 16, 1853.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Scorpii	5	47	31.2	57	19	30
	5	48	35.4	57	22	00
	5	50	48.9	57	24	00
	5	51	37.6	57	24	50
	5	52	24.5	57	25	50
	5	53	10.1	57	26	05
	5	54	08.8	57	26	50
	5	55	02.5	57	27	40
	5	56	06.2	57	27	40
	5	57	05.0	57	28	00
	5	58	35.9	57	28	40
	6	00	03.5	57	28	40
	6	00	59.9	57	28	20
	6	02	02.6	57	28	20
	6	03	00.1	57	28	00
	6	03	49.9	57	27	50
Moon's W. limb	6	06	05.0	67	40	50
Jupiter	6	07	09.1	64	19	20
Dist. between Jupiter and moon's W. limb.	6	08	49.2?	8	49	50
	6	10	17.9	8	49	10
	6	11	19.0	8	49	10
	6	12	30.8	8	48	30
	6	13	39.9	8	48	00
Jupiter	6	15	14.5	64	43	30
Moon's W. limb	6	16	57.2	67	23	10
Arcturus	6	20	09.1	106	47	40
	6	21	25.0	106	18	00
	6	22	15.2	105	55	20
	6	23	26.9	105	28	20
	6	24	29.6	105	04	40
	6	25	32.5	104	39	00
	6	28	36.6	103	26	50
α Cygni	6	30	58.8	93	54	50
	6	31	54.0	94	13	30
	6	32	57.9	94	34	50
	6	34	21.2?	95	05	20
	6	51	22.2?	104	22	50
	6	54	16.0	102	06	40
	6	55	19.9?	102	29	30
	6	56	10.2	102	47	20
	6	57	28.2	102	47	20
Polaris	6	38	39.1	69	12	00
	6	39	37.9	69	13	50
	6	41	26.7	69	13	50
	6	43	32.2	69	15	10
	6	44	53.9	69	15	40
	6	45	52.0	69	15	30
	6	46	56.1	69	16	40
	6	48	01.8	69	17	00
	6	48	53.5	69	17	00

Index error — 9′ 40″. Barometer, 29.59 in. Thermometer detached, 26°.9. Therm'r attached, 75°.

APPENDIX A—Continued.

CAMP No. 2, (*Scullyville*)—JULY 19, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Altair	7	54	38.5	113	05	10
α Coronæ Borealis	7	57	56.1	106	20	40
	7	58	59.4	105	54	24
	7	59	53.0	105	33	00
	8	00	35.9	105	15	00
	8	01	42.3	104	48	30
	8	02	49.9	104	19	50
	8	05	27.0	103	15	50
α Cygni	8	07	44.6?	127	56	40
	8	09	10.2	128	27	20
	8	11	04.3	129	06	10
	8	12	37.5?	129	39	10
	8	13	38.9	129	59	50

Index error — 9′ 50″. Thermometer detached 81°.5. Thermometer att'd, 80°. Barometer, U. V., 31.028 in. Barometer, L. V., 1.382 in. Barometer, 29.646 in.

CAMP No. 2, (*Scullyville*)—JULY 22, 1853.

Polaris	7	55	46.4	69	19	50
	7	56	48.8	69	21	00
	7	57	39.3	69	21	10
	7	58	26.8	69	21	00
	7	59	16.4	69	20	30
	8	00	30.6	69	21	30

Index error — 9′. Barometer, 29.575 in. Thermometer attached, 74°.2. Thermometer detached, 79°.9.

CAMP No. 2, (*Scullyville*)—JULY 23, 1853.

Arcturus	6	01	25.2	114	16	40
	6	02	23.6	113	53	40
	6	03	13.5	113	35	50
	6	04	07.0	113	14	10
	6	04	59.6	112	53	00
	6	54	29.4	93	13	30
	6	55	12.0	92	57	00
	6	56	03.9	92	35	20
	6	56	51.2	92	17	20
	6	58	10.5	91	43	40
	6	59	21.6	91	15	30
α Lyræ	6	11	02.8	131	47	50
	6	12	07.9	132	13	10
	6	13	19.6	132	40	00
	6	14	10.9	133	00	30
Altair	6	16	59.8	79	53	40
	6	17	57.6	80	15	30
	6	45	13.0	90	25	10
	6	46	28.4	90	52	50
	6	48	46.3	91	42	00
	6	49	40.9	92	01	50
	6	50	35.4?	92	21	00
	6	51	29.0	92	40	10
	6	52	29.6	93	02	10

CAMP No. 2, (*Scullyville*)—JULY 23, 1853—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	6	22	12.8	68	58	20
	6	23	38.6	68	58	40
	6	24	50.0	68	59	00
	6	26	24.2	68	59	40
	6	27	31.6	69	00	00
	6	28	38.9	69	01	40
	6	29	18.5	69	01	50
	6	30	08.3	69	02	40
	6	31	02.8	69	03	40
	6	32	04.0	69	03	50
Jupiter	6	37	52.0	65	16	10
	6	38	27.6	65	15	10
	6	39	15.9	65	16	00
	6	39	58.0	65	15	40
	6	40	45.6	65	14	50
	6	41	25.4	65	14	10
	6	42	05.0	65	13	50
	6	42	51.3	65	12	50

Index error — 9′ 30″. Barometer, 29.528 in. Thermometer attached, 80°. Termometer detached, 83°.6.

CAMP No. 3—JULY 26, 1853.

Altair	20	06	40.1	116	07	40
	20	08	01.7	116	28	30
	20	09	27.2	116	50	00
	20	10	31.8	117	05	00
	20	11	20.9	117	17	00
α Coronæ Borealis	20	14	59.3	99	40	00
	20	16	00.5	99	17	40
	20	17	08.9	98	49	00
	20	18	13.0	98	22	30
	20	19	10.2	97	58	40
Polaris	20	22	06.1	70	16	40
	20	23	14.0	70	19	30
	20	24	29.9	70	18	10
	20	26	46.0	70	21	20
	20	27	35.8	70	21	20

Index error — 9′ 30″. Barometer, 29.5 in. Thermometer, 70°.

CAMP No. 4—JULY 27, 1853.

α Lyræ	18	05	38.8	129	13	00
	18	06	43.0	129	38	20
	18	07	31.6	129	57	50
	18	08	40.4	130	24	00
	18	09	27.5	130	43	00
Arcturus	18	11	13.7	110	54	10
	18	12	22.5	110	26	30
	18	13	38.3	109	57	10
	18	14	37.1	109	34	40
	18	15	28.6	109	13	40

APPENDIX A—Continued.

CAMP No. 4—JULY 27, 1853—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	18	19	49.9	68	49	50
	18	21	17.0	68	51	05
	18	22	36.8	68	51	40
	18	23	42.1	68	53	00
	18	24	55.4	68	54	00
	18	44	15.9	69	05	30
	18	45	07.2	69	05	50
Jupiter	18	28	40.2	65	20	20
	18	29	32.5	65	20	20
	18	30	41.1	65	21	50
	18	31	24.5	65	22	30
	18	32	19.6	65	22	50
	18	33	08.7	65	22	50
	18	34	19.9	65	22	40
	18	36	37.4	65	22	30
	18	38	41.2	65	22	20
	18	39	39.9	65	22	50
	18	40	58.0	65	21	40
	18	42	03.6	65	20	10

Index error — 09′ 30″. Barometer, 29.604 in. Thermometer, 66°.

CAMP No. 4—JULY 28, 1853.

Arcturus	18	10	07.0	111	19	00
	18	10	37.2	110	59	50
	18	11	48.4	110	39	10
	18	13	42.6	109	54	00
	18	14	31.2	109	35	10
	18	15	33.1	109	11	20
Altair	18	19	28.4	80	26	10
	18	20	36.9	80	52	50
	18	21	32.2	81	14	10
	18	22	30.1	81	35	40
	18	24	43.9	82	27	10
	18	25	48.3	82	51	30
Polaris	18	29	26.3	68	56	00
	18	30	33.5	68	56	30

Index error — 10′. Barometer, 29.667 in. Thermometer, 73°.

CAMP No. 6—JULY 30, 1853.

Arcturus	18	27	58.6	104	39	10
	18	29	01.4	104	13	30
	18	30	09.2	103	45	40
	18	31	19.6	103	18	00
	18	32	12.3	102	56	40
	18	33	20.0	102	30	00
	18	34	12.5	102	08	10
α Cygni	18	38	18.9	95	33	40
	18	39	49.2	96	05	20
	18	41	18.3	96	37	30
	18	42	50.1	97	08	30
	18	43	59.9	97	33	50
	18	45	05.4	97	56	00
	18	46	37.2	98	28	00

CAMP No. 6—JULY 30, 1853—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	18	50	02.2	69	03	40
	18	51	37.1	69	04	00
	18	53	19.9	69	06	00
	18	55	01.0	69	07	00
	18	56	31.1	69	09	00
	18	58	21.2	69	10	20
	19	01	01.4	69	11	00
	19	02	02.5	69	12	00
	19	04	15.7	69	13	30

Index error — 9′ 50″. Barometer, 29.664 in. Thermometer, 75°.

CAMP No. 7—JULY 31, 1853.

Arcturus	18	23	34.6	106	38	50?
	18	25	12.9	106	00	00
	18	25	48.6	105	46	00
	18	26	22.9	105	32	10
	18	26	58.8	105	17	40
α Cygni	18	29	07.4	92	03	00
	18	29	48.1	92	17	50
	18	30	35.3	92	33	20
	18	31	23.8	92	50	20
	18	32	07.0	93	06	20
Jupiter	18	35	48.2	65	34	30
	18	36	44.9	65	33	20
	18	37	42.9	65	34	00
	18	38	40.0	65	33	40
	18	39	19.5	65	33	20
	18	40	07.9	65	33	20
	18	40	52.0	65	33	00
	18	41	47.4	65	32	10
	18	42	38.0	65	31	20
Polaris	18	45	35.4	68	55	45
	18	47	02.5	68	56	40
	18	48	06.7	68	58	00
	18	49	15.2	68	58	30
	18	50	10.0	68	59	00
	18	51	31.9	69	00	40
	18	52	31.2	69	00	30
Arcturus	18	58	00.9	92	51	30
	18	59	17.8	92	20	40
	19	00	06.0	92	00	40
	19	00	53.3	91	42	10
	19	01	52.2	91	18	00
α Cygni	19	04	10.0	104	23	30
	19	05	11.2	104	45	40
	19	06	11.2	105	06	50
	19	07	14.3	105	29	40
	19	08	09.2	105	48	30

Index error — 10′ 20″. Barometer, 29.633 in. Thermometer, 73°.

APPENDIX A—Continued.

CAMP No. 8—August 1, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Cygni	18	43	49.4	97	00	10
	18	46	13.8	97	52	40
	18	47	10.5	98	12	20
	18	48	00.2	98	30	10
	18	48	47.9	98	46	10
	18	49	32.4	99	01	50
	18	50	19.4	99	19	40
Jupiter	18	52	54.6	65	21	00
	18	53	30.7	65	19	30
	18	54	20.0	65	17	50
	18	55	02.2	65	16	20
	18	55	49.8	65	14	30
Arcturus	19	00	00.5	92	15	20
	19	01	25.2	91	40	00
	19	01	59.3	91	27	10
	19	02	33.8	91	13	40
	19	03	23.6	90	52	40
	19	04	12.4	90	32	20
	19	54	54.7	90	15	10
Polaris	19	06	50.8	69	07	40
	19	09	31.0	69	09	20
	19	10	40.9	69	10	20
	19	11	35.4	69	11	00
	19	12	31.1	69	12	00
	19	13	17.1	69	12	40
	19	14	11.9	69	13	10
	19	15	16.7	69	13	30
	19	15	57.2	69	14	00
	19	16	44.6	69	14	20

Index error — 11′ 30.″ Barometer 29.553 in. Thermometer 78°.

CAMP No. 9—August 2, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
First reading.						
Arcturus	18	26	01.7	106	07	50
	18	26	54.6	105	46	40
	18	27	40.3	105	28	40
	18	28	41.6	105	03	20
	18	29	54.0	104	34	50
Second reading.						
Arcturus	18	57	08.0	93	39	40
	18	58	00.2	93	17	30
	18	58	57.6	92	54	40
	18	59	37.9	92	37	40
	19	00	21.5	92	20	00
First reading.						
α Cygni	18	32	14.5	92	45	10
	18	33	16.0	93	08	20
	18	34	26.4	93	33	10
	18	35	16.2	93	50	10
	18	35	57.8	94	04	20

CAMP No. 9—August 2, 1853—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
Second reading.						
	h.	m.	s.	°	′	″
α Cygni	19	03	29.1	103	46	50
	19	04	34.3	104	09	30
	19	05	35.8	104	32	40
	19	06	30.4	104	51	10
	19	08	15.0	105	29	00
	19	09	01.2	105	46	30
	19	10	02.4	106	06	50
	19	11	36.0	106	40	10
Jupiter	18	37	47.5	65	34	40
	18	38	44.9	65	35	10
	18	39	39.4	65	34	40
	18	40	38.9	65	34	20
	18	41	38.3	65	34	10
	18	42	36.5	65	33	00
Polaris	18	47	32.9	68	55	20
	18	48	35.2	68	56	00
	18	49	35.3	68	56	30
	18	50	41.1	68	57	50*d*
	18	51	49.9	68	57	30
	18	53	04.4	68	59	10
	18	53	51.9	68	59	40
	18	54	57.1	69	00	10*d*

Index error — 10′ 30″. Barometer 29.399 in. Thermometer attached 75°. Thermometer detached 76°.

CAMP No. 9—August 3, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
Arcturus	18	31	37.9	103	55	50
	18	32	23.3	103	37	00
	18	33	00.7	103	21	30
	18	33	37.6	103	06	40
	18	34	16.4	102	51	20
Polaris	18	36	41.8	68	48	50
	18	37	47.0	68	50	10
	18	38	49.7	68	50	40
	18	39	39.1	68	51	20
	18	40	31.0	68	52	40
α Cygni	19	01	14.1	102	58	00
	19	02	11.8	103	19	10
	19	03	30.2	103	47	00
	19	04	12.3	104	01	45
	19	04	55.4	104	17	00

Index error — 10′ 30″. Barometer 29.439 in. Ther. 86°.

CAMP No. 10—August 4, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
Arcturus	18	46	39.4	98	19	50
	18	47	35.1	97	57	30
	18	48	37.5	97	36	30
	18	49	32.1	97	10	10
	18	50	47.0	96	41	00
	18	51	28.6	96	24	30

APPENDIX A—Continued.

CAMP No. 10—AUGUST 4, 1853—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Jupiter	18	59	44.9	65	17	10
	19	00	52.3	65	13	50
	19	01	42.0	65	11	30
	19	02	25.4	65	09	20
	19	03	13.0	65	08	10*d*
	19	04	05.1	65	05	20

Index error —10′ 30″. Barometer 29.46. in. Therm. 82°.

CAMP No. 11—AUGUST 5, 1853.

Jupiter	18	48	35.2	65	39	30
	18	49	30.1	65	38	40
	18	50	05.6	65	37	10
	18	50	49.7	65	36	30
	18	51	26.9	65	35	50
Areturus	18	53	21.1	95	43	30
	18	54	34.9	95	13	30
	18	55	23.2	94	54	40
	18	55	55.8	94	40	10
	18	57	40.2	93	58	50
a Cygni	19	01	52.7	102	40	10
	19	02	55.1	103	02	10
	19	04	04.9	103	26	40
	19	05	49.4	104	04	10
	19	06	41.3	104	23	10
Polaris	19	10	06.1	68	59	40
	19	11	09.7	68	59	50
	19	12	29.4	69	01	20
	19	14	26.1	69	02	30
	19	15	16.4	69	03	10
	19	18	41.8	69	05	20
	19	20	03.4	69	06	20
	19	21	10.5	69	07	10

Index error — 10′ 50″. Barometer, 29.527 in. Thermometer, 76°.5.

CAMP No. 13—AUGUST 7, 1853.

Areturus	18	40	20.5	101	25	10
	18	40	58.7	101	11	00
	18	41	30.4	100	58	40
	18	42	10.3	100	42	50
	18	42	43.0	100	30	00
	18	43	23.5	100	13	20
Jupiter	18	49	42.4	65	42	50
	18	50	39.1	65	41	50
	18	51	12.0	65	40	40
	18	51	54.9	65	39	50
	18	53	26.1	65	38	20
	18	54	01.9	65	36	20
a Cygni	18	55	59.0	100	09	10
	18	56	44.2	100	25	10
	18	57	35.1	100	42	50
	18	58	18.5	100	57	30
	18	59	09.1	101	17	00
	18	59	54.2	101	32	40

CAMP No. 13—AUGUST 7, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	19	02	31.8	68	50	00
	19	03	30.1	68	50	40
	19	04	19.0	68	51	00
	19	04	56.7	68	52	00
	19	05	47.0	68	52	00
	19	06	31.9	68	52	50
	19	08	03.5	68	54	00

Index error —10′. Barometer, 29.45 in. Thermometer, 75°.5.

CAMP No. 14—AUGUST 8, 1853.

Jupiter	18	48	59.0	65	51	00
	18	49	28.5	65	50	30
	18	50	21.4	65	49	30
	18	51	32.6	65	47	50
	18	52	11.7	65	46	40
Areturus	18	54	11.6	96	06	10
	18	54	52.2	95	50	10
	18	55	31.9	95	33	40
	18	56	22.4	95	13	30
	18	56	54.5	94	59	50
a Cygni	18	58	22.5	100	43	30
	18	59	06.9	100	59	20
	19	00	01.3	101	18	50
	19	00	52.6	101	38	10
	19	02	54.7	102	21	40
Polaris	19	05	20.0	68	43	50
	19	06	17.0	68	44	30
	19	07	29.9	68	45	10
	19	08	27.3	68	45	50
	19	10	05.0	68	47	10
	19	10	52.9	68	48	10
	19	11	43.0	68	47	00
	19	12	29.8	68	48	30

Index error —10′ 30″. Barometer, 29.338 inches. Thermometer, 77°.5.

CAMP No. 15—AUGUST 9, 1853.

Jupiter	18	40	28.4	65	56	30
	18	41	38.2	65	55	30
	18	42	31.1	65	55	30
	18	43	26.0	65	55	10
	18	44	46.1	65	55	00
Polaris	18	50	56.3	68	34	50
	18	53	02.5	68	35	00
	18	54	07.0	68	36	50
	18	54	49.4	68	37	10
	18	55	43.3	68	38	00
	18	56	22.6	68	38	10
	18	56	55.0	68	38	00
	18	57	49.3	68	39	30

APPENDIX A—Continued.

CAMP No. 15—AUGUST 9, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Cygni	19	00	19.0	101	11	40
	19	03	46.2	102	25	20
	19	04	34.7	102	43	20
	19	05	09.1	102	55	30
	19	05	46.0	103	08	40
	19	06	33.1	103	25	50
Arcturus	19	12	47.1	88	47	00
	19	13	36.0	88	29	40
	19	15	53.3	87	32	20
	19	16	47.6	87	09	20
	19	17	40.0	86	47	30
	19	18	48.9	86	20	20

Index error — 10′. Barometer, 29.354 in. Thermometer, 79°.2.

CAMP No. 16—AUGUST 10, 1853.

Jupiter	18	57	32.0	65	39	15
	18	58	49.9	65	37	20
	18	59	23.6	65	36	20
	19	00	51.2	65	32	50
	19	01	27.4	65	31	30
Arcturus	19	03	05.7	92	59	30
	19	03	41.6	92	44	30
	19	04	35.0	92	22	40
	19	05	17.2	92	06	40
	19	05	59.9	91	48	20
α Cygni	19	08	09.8	103	40	40*d*
	19	09	18.5	104	09	10
	19	11	42.4	105	01	00
	19	10	31.0	104	35	10*d*
	19	12	40.2	105	21	40
	19	13	47.5	105	45	50
	19	14	39.0	105	03	40
Polaris	19	17	28.1	68	50	20
	19	18	33.5	68	51	40
	19	19	52.1	68	52	20
	19	20	41.3	68	53	20
	19	21	27.4	68	53	20
	19	23	04.4	68	54	40
	19	23	53.9	68	54	50
	19	24	40.2	68	56	40

Index error — 10′. Barometer, 29.362 in. Thermometer, 76°.9.

CAMP No. 17—AUGUST 11, 1853.

Jupiter	18	49	16.0	66	33	00
	18	49	48.4	66	02	40
	18	50	17.8	66	02	10
	18	51	08.4	66	01	40
	18	51	40.4	66	01	00
	18	52	08.5	66	00	20

CAMP No. 17—AUGUST 11, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Arcturus	18	53	54.1	96	56	10
	18	54	37.9	96	38	40
	18	55	16.1	96	23	30
	18	56	01.5	96	04	50
	18	56	34.3	95	51	10
	18	57	10.6	95	57	00
α Cygni	18	59	04.6	100	16	20
	18	59	46.9	100	31	10
	19	00	18.7	100	43	30
	19	01	10.7	101	02	00*d*
	19	02	02.2	101	19	30
	19	03	06.0	101	42	00
Polaris	19	05	30.0	68	30	00
	19	06	28.4	68	31	50
	19	07	23.3	68	32	00
	19	22	58.2	68	43	00
	19	24	00.0	68	44	20
	19	24	51.5	68	44	30
	19	25	32.1	68	44	50
	19	26	21.0	68	45	50
Dist. betw. Moon's W. limb & Spica.	19	43	39.6	26	52	40
	19	45	38.5	26	54	10
	19	46	43.9	26	54	10
	19	48	27.8	26	54	10
	19	49	54.1	26	55	10
Dist. betw. Moon's W. limb & Antares.	19	53	14.5	20	29	50
	19	54	14.1	20	29	00
	19	55	29.9	20	28	50
Dist. betw. Moon's W. limb and Jupiter.	19	57	55.0	26	26	50
	19	59	47.6	26	25	40
	20	00	44.9	26	24	50

Index error — 10′. Barometer, 29.398 in. Thermometer, 70°.7.

CAMP No. 17—AUGUST 12, 1853.

α Cygni	19	20	46.5	107	58	10
	19	22	26.6	108	34	00
	19	23	23.2	108	54	10
	19	24	20.0	109	15	10
	19	25	05.2	109	31	30
	19	25	49.0	109	46	10
Arcturus	19	30	38.6	81	58	40
	19	31	15.4	81	43	20
	19	31	46.7	81	30	20
	19	32	24.1	81	14	30
	19	33	16.6	80	52	40
	19	38	53.5	80	37	30
α Coronæ Borealis	19	42	44.4	116	01	10
	19	43	30.9	115	42	40

Index error — 10′ 10″. Barometer, 29.342 in. Thermometer, 70°.6.

APPENDIX A—Continued.

CAMP No. 17—August 13, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Cygni	19	05	00.9	102	21	00
	19	05	37.5	102	34	50
	19	06	18.2	102	49	20
	19	06	55.1	103	02	30
	19	07	51.1	103	21	30
Arcturus	19	09	15.2	90	43	00
	19	09	48.5	90	29	40
	19	10	13.4	90	19	30
	19	10	45.0	90	06	50
	19	11	26.7	89	50	10
Moon's W. limb	19	16	19.0	63	17	00
Dist. between Spica & Moon's W. limb.	19	20	52.9	54	58	30
	19	22	21.6	54	59	10
	19	23	40.4	55	01	30
	19	24	32.0	55	01	50
	19	25	14.6	55	02	00
Moon's W. limb	19	25	54.3	62	43	40
Altair	19	35	15.2	105	16	30
Dist. between the Moon and Altair.	19	42	41.4	51	02	00
	19	44	19.9	51	01	50
	19	45	17.1	51	01	40
	19	46	40.2	51	00	30
	19	47	45.0	50	00	20
Altair	19	51	16.5	110	16	40
Moon's W. limb	19	52	15.5	60	21	20
Polaris (AWW)	19	56	16.9	69	08	10
	19	57	33.3	69	08	20
Polaris (GGG)	19	54	32.0	69	09	10
	19	55	48.9	69	09	20
	19	58	25.6	69	10	00

Index error — 10′. Barometer 29.314 in. Ther. 68°.2.

CAMP No. 18—August 14, 1853.

α Cygni	19	05	41.9	102	13	50
	19	08	15.5	103	05	30
	19	12	20.2	103	06	30
	19	15	59.3	102	55	00
	19	17	06.8	103	15	30
Arcturus	19	31	40.1	81	52	10
	19	34	13.6	80	50	00
	19	35	38.8	80	13	40
	19	36	24.1	79	55	00
	19	37	13.0	79	34	00
Polaris	19	53	18.8	69	00	00
	19	56	58.9	68	58	00
	20	00	07.0	68	59	00
	20	02	25.5	69	02	00
	20	03	51.4	69	01	50

Index error — 10′. Barometer 29.222 in. Ther. 72°.6.

CAMP No. 19—August 15, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Arcturus	19	10	27.0	90	50	00
	19	12	09.8	90	08	50
	19	14	10.4	89	17	40
	19	16	50.7	88	12	50
	19	17	26.9	87	58	20
	19	18	01.2	87	43	30
	19	18	35.8	87	29	20
	19	19	06.1	87	17	40
Cygni	19	20	31.0	107	18	40
	19	21	22.6	107	37	30
	19	22	18.2	107	56	50
	19	22	53.5	108	10	10
	19	23	32.6	108	23	40
Polaris	19	29	03.5	68	34	10
	19	29	44.0	68	35	30
	19	30	25.2	68	36	00
	19	31	03.0	68	36	20
	19	31	51.6	68	37	00

Index error — 10′. Barometer 29.051 in. Ther. 74°.9.

CAMP No. 20—August 16, 1853.

Polaris	20	02	03.0	69	01	00
	20	02	43.8	69	01	50
	20	03	18.2	69	02	10
	20	03	50.0	69	03	10
	20	04	20.4	69	03	10
	20	05	08.3	69	04	00
	20	05	46.7	69	04	20
	20	06	23.5	69	04	30
	20	07	00.0	69	05	20
	20	07	48.6	69	06	00
α Cygni	20	09	30.6	124	20	10
	20	10	29.5	124	42	00
	20	11	43.2	125	07	40
	20	12	27.6	125	23	10
	20	13	10.1	125	38	30
Coronæ Borealis	20	20	13.1	101	32	00
	20	23	51.6	100	01	20
	20	24	35.0	99	44	00
	20	25	29.1	99	22	50
	20	26	21.0	99	00	40
	20	26	54.8	98	47	00
	20	27	36.2	98	29	50

Index error — 10′. Barometer 29.017 in. Ther. 70°.95.

CAMP No. 21—August 17, 1853.

Arcturus	19	23	55.4	85	49	20
	19	24	27.3	85	37	00
	19	24	56.5	85	24	50
	19	25	32.7	85	09	40
	19	26	17.1	84	52	40
	19	26	51.6	84	37	30

APPENDIX A—Continued.

CAMP No. 21—AUGUST 17, 1853—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Cygni	19	29	17.0	110	01	00
	19	30	04.4	110	18	40
	19	30	47.6	110	33	30
	19	31	23.9	110	47	10
	19	32	03.1	111	00	40
	19	32	44.0	111	15	20
Polaris	19	38	18.6	68	57	20
	19	39	33.7	68	59	00
	19	40	35.9	69	00	00
	19	41	44.1	69	00	40
	19	42	39.6	69	01	50
	19	43	37.6	69	02	40
	19	44	26.4	69	03	10
	19	45	47.0	69	03	10
	19	46	27.9	69	04	00
	19	47	17.2	69	04	20
Coronæ Borealis	19	51	14.2	113	35	50
	19	56	36.6	111	27	20
	19	57	19.2	111	09	20
	19	58	04.5	110	51	50
	19	59	11.7	110	23	30
	19	59	47.5	110	09	20
	20	00	35.1	109	42	30
Jupiter	20	02	25.0	60	05	00
Moon's upper limb	20	04	06.4	39	15	00
Dist. between Moon's W. limb and Jupiter.	20	07	38.9	59	52	50
	20	09	16.0	59	53	10
	20	11	31.1	59	54	10
Moon's upper limb	20	12	23.0	41	32	30
Jupiter	20	14	06.9	58	15	20

Index error — 9′. Barometer, 28.984 in. Thermometer, 67°.

CAMP No. 21—AUGUST 18, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Jupiter	19	36	53.5	63	15	20
	19	37	32.6	63	11	10
Arcturus	19	38	54.5	79	43	20
	19	39	31.8	79	28	10
	19	40	05.4	79	15	00
	19	40	32.9	79	03	20
	19	41	06.5	78	50	00
α Cygni	19	42	42.1	114	46	00
	19	43	28.0	115	02	50
	19	44	03.3	115	15	00
	19	44	39.1	115	28	10
	19	45	15.2	115	40	50
Coronæ Borealis	19	46	25.0	115	41	30
	19	47	02.1	115	27	10
	19	47	54.6	115	05	00
	19	48	40.9	114	44	50
	19	49	24.7	114	27	10
	19	50	08.0	114	10	20

CAMP No. 21—AUGUST 18, 1853—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	19	54	08.4	69	08	50
	19	55	23.2	69	09	40
	19	55	59.9	69	10	30
	19	56	34.8	69	11	00
	19	57	27.8	69	11	00
	19	58	15.0	69	12	20
	19	58	49.4	69	13	30

Index error — 9′ 40″. Barometer, 28.974 in. Thermometer, 70°.

CAMP No. 21—AUGUST 20, 1853.

α Coronæ Borealis	19	58	11.4	110	53	00
	19	59	04.2	110	33	10
	19	59	52.0	110	12	40
	20	01	01.9	109	43	40
	20	01	48.5	109	23	40
α Cygni	20	06	11.0	123	00	20
	20	06	41.6	123	12	20
	20	07	24.3	123	27	00
	20	08	08.1	123	42	30
	20	09	07.2	124	03	20

Index error — 9′. Barometer, 28.912 in. Thermometer, 78°.

CAMP No. 21—AUGUST 21, 1853.

Dist. between comet and Jupiter.	19	50	23.0	92	26	30
Dist. between comet and Arcturus.	19	52	51.1	37	06	20
Dist. between comet and	19	56	33.3	94	31	10
α Coronæ Borealis	19	59	42.6	110	18	30
	20	00	23.1	110	01	00
	20	01	03.8	109	44	20
	20	02	06.2	109	18	40
	20	02	48.9	109	01	30
Altair	20	06	33.3	113	45	10
	20	07	15.5	113	56	30
	20	08	23.4	114	14	10
	20	09	31.5	114	33	30
	20	10	47.4	114	53	20
Polaris	20	15	56.8	69	26	00
	20	16	56.7	69	26	40
	20	17	43.2	69	27	40
	20	18	53.0	69	28	20
	20	20	01.9	69	29	40

Index error — 10′ 50″. Barometer, 28.936 in. Thermometer, 76°.8.

APPENDIX A—Continued.

SEXTANT No. 1.

CAMP No. 22—AUGUST 22, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Dist. between comet and Jupiter.	19	42	19.6	91	46	10
	19	43	28.3	91	45	50
	19	45	16.1	91	46	30
Dist. between comet and Arcturus.	19	49	35.1	36	33	30
	19	50	37.4	36	33	00
	19	51	45.0	36	32	20
Dist. between comet and	19	55	25.9	92	39	00
	19	57	38.2	92	38	30
	19	58	57.6	92	36	50
Dist. between comet and Polaris.	20	06	13.1	65	17	40
α Coronæ Borealis	20	24	25.6	90	43	50
	20	25	25.4	90	20	10
	20	26	18.9	89	59	00
	20	27	15.5	89	35	40
	20	27	37.7	89	17	50
	20	28	43.4	89	59	10
	20	29	36.5	88	37	20
α Pegasi	20	31	59.9	84	23	00
	20	33	36.2	84	59	20
	20	34	54.0	85	28	10
	20	36	06.9	85	56	00
	20	36	55.0	86	15	00
	20	37	45.6	86	33	30
	20	38	38.5	86	55	00
Polaris	20	42	08.1	69	43	00
	20	42	55.4	69	44	00
	20	44	06.8	69	44	35
	20	45	12.0	69	45	30
	20	45	57.7	69	46	20
	20	46	54.8	69	46	00
	20	48	04.4	69	47	00

Index error — 02′ 40″. Barometer, 28.852 in. Thermometer, 79°.3.

CAMP No. 23—AUGUST 23, 1853.

Altair	19	29	24.4	101	24	30
	19	30	03.2	101	37	00
	19	31	00.1	101	56	30
	19	31	45.0	102	11	00
	19	32	19.6	102	22	50
	19	33	01.8	102	37	40
	19	33	41.4	102	50	30
Polaris	19	36	28.9	69	01	40
	19	37	29.4	69	02	10
	19	38	12.7	69	03	00
	19	38	53.1	69	03	50
	19	39	42.4	69	04	20
	19	40	32.3	69	05	10
	19	41	11.4	69	05	50
Arcturus	19	43	31.5	77	30	10
	19	44	52.4	78	57	00

CAMP No. 23—AUGUST 23, 1853—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Arcturus	19	45	31.2	77	41	20
	19	46	19.1	77	22	10
	19	47	18.6	76	56	50
	19	48	03.3	76	38	30
	19	48	37.4	76	23	40
α Coronæ Borealis	20	01	29.1	110	09	00
	20	02	24.4	109	47	50
	20	04	40.3	108	51	20
	20	05	46.5	108	26	00
	20	07	00.9	107	52	50

Index error — 02′ 50″. Barometer, 28.896 in. Thermometer, 74°.9.

CAMP No. 25—AUGUST 25, 1853.

Jupiter	19	20	03.5	64	20	00
	19	20	30.6	64	18	00
	19	21	00.9	64	15	40
	19	21	28.3	64	14	10
	19	22	07.5	64	11	30
Arcturus	19	25	40.4	86	10	20
	19	26	24.0	85	52	40
	19	27	03.4	85	36	50
	19	28	02.1	85	13	00
	19	28	44.5	84	54	50
	19	29	19.6	84	41	10
Dist. between comet and Arcturus.	19	36	20.1	35	46	00
	19	39	07.0	35	46	50*d*
	19	40	15.2	35	46	10
Dist. between comet and Polaris.	19	45	51.9	69	00	00
	19	46	42.0	68	59	00
	19	47	39.9	68	59	10
ε Pegasi	20	49	28.8	82	57	50
	20	51	15.9	83	37	50
	20	52	30.3	84	05	50
	20	53	09.1	84	31	10
	20	53	43.6	84	54	30
	20	55	46.7	85	19	10
	20	56	30.5	85	35	20
Altair	20	55	23.7	123	57	30
Polaris	21	01	33.8	70	15	20
	21	02	15.2	70	15	40
	21	03	05.7	70	16	30
	21	04	00.4	70	17	50
	21	04	44.5	70	18	00
	21	06	31.9	70	19	20
	21	08	02.8	70	19	10
	21	09	19.0	70	21	20
	21	10	01.8	70	21	40

Index error — 02′ 50″. Barometer 28.740 in. Thermometer 72°.03. The comet appeared much the same as last night.

APPENDIX A—Continued.

CAMP No. 27—AUGUST 27, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Coronæ Borealis	20	28	55.9	100	01	20
	20	30	49.4	99	14	50
	20	32	10.3	98	43	00
	20	33	01.9	98	21	00
	20	36	17.3	97	03	00
Polaris	20	41	37.1	70	27	00
	20	43	21.4	70	29	40
	20	44	28.0	70	30	20
	20	45	03.9	70	31	10
	20	45	40.0	70	32	00
	20	47	03.1	70	33	00
	20	48	02.8	70	33	20
	20	50	04.3	70	34	20

Index error — 03′. Barometer 28.886 in. Ther. 64°.

SEXTANT No. 2.

CAMP No. 28—AUGUST 28, 1853.

Dist. between the comet & Arcturus	20	00	47.8	36	28	30
Comet and Jupiter	20	03	47.8	87	45	20
Comet and Polaris	20	06	16.0	74	08	30
α Coronæ Borealis	20	23	14.2	102	49	30
	20	25	17.3	101	59	20
	20	26	57.5	101	19	30
	20	29	02.1	100	28	30
	20	30	02.9	100	02	40
	20	31	19.9	99	32	00
	20	32	21.0	99	06	50
Arcturus	20	34	30.2	59	16	20
	20	35	20.3	58	54	50
	20	36	10.4	58	34	40
	20	37	06.6	58	12	40
α Pegasi	20	41	02.4	60	22	20
	20	41	51.0	60	43	40
	20	42	53.2	61	07	00
	20	43	55.4	61	32	30
ε Pegasi	20	46	49.1	88	12	20
	20	47	28.3	88	26	30
	20	48	29.4	88	50	00
	20	49	27.1	89	10	00
	20	50	11.9	89	26	50
	20	51	21.5	89	52	20
	20	52	17.8	90	13	30
Polaris	20	54	13.4	70	58	20
	20	55	14.9	70	58	40
	20	56	25.3	70	59	20
	20	57	18.0	71	00	40
	20	58	24.2	71	01	00
	20	59	02.3	71	01	10
	20	59	43.5	71	01	40

Index error — 11′ 50″. Barometer 28.576 in. Ther. 72°.2.

CAMP No. 29—AUGUST 29, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Coronæ Borealis	21	01	43.5	87	41	20
	21	03	17.2	87	04	10
	21	07	19.6	85	27	50
	21	08	10.0	85	06	00
	21	10	47.8	84	02	10
	21	12	40.6	83	17	00
	21	13	33.3	82	55	10
Polaris	21	16	47.6	71	19	00
	21	18	00.0	71	19	30
	21	18	43.9	71	20	10
	21	19	41.2	71	20	50
	21	20	24.1	71	20	50
	21	21	16.6	71	22	50
	21	22	17.3	71	23	00
	21	23	11.2	71	24	00
	21	24	34.4	71	24	00
	21	25	25.2	71	25	30
ε Pegasi	21	27	56.4	102	14	50
	21	29	17.7	102	42	10
	21	30	48.0	103	12	40
	21	31	57.8	103	36	00
	21	32	47.2	103	52	20

Index error — 11′ 50″. Barometer 28.474 in. Ther. 72°.6.

CAMP No. 30—AUGUST 30, 1853.

α Cygni	19	45	41.3	113	45	50
	19	46	27.5	114	01	50
	19	47	04.8	114	15	10
	19	47	43.6	114	29	00
	19	49	22.1	115	04	00
	19	50	00.2	115	17	00
	19	51	10.2	115	42	20
Arcturus	19	52	55.3	77	09	00
	19	53	35.6	76	53	20
	19	54	13.7	76	37	30
	19	55	31.5	76	05	30
	19	56	15.1	75	47	50
	19	56	47.3	75	35	30
Dist. between the comet & Arcturus.	19	59	19.6	38	07	50
Polaris	20	06	24.6	70	31	30
	20	07	02.2	70	31	40
	20	07	35.0	70	32	20
	20	08	23.1	70	32	50
	20	09	00.9	70	33	20
	20	09	38.0	70	33	20
	20	10	12.3	70	33	50
	20	10	58.7	70	34	20
	20	12	04.8	70	35	40

Index error — 11′ 40″. Barometer 28.411 in. Ther. 74°.

APPENDIX A—Continued.

CAMP No. 31—August 31, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Arcturus	19	51	59.1	77	52	10
	19	53	04.0	77	25	40
	19	53	47.6	77	08	40
	19	55	09.5	76	34	30
	19	55	48.3	76	19	40
	19	56	57.9	75	50	50
ε Pegasi	20	14	04.9	74	25	00
	20	15	12.2	74	52	10
	20	16	10.1	75	15	00
	20	17	35.4	75	47	30
	20	18	33.5	76	10	10
	20	19	33.4	76	33	30
	20	21	04.3	77	08	10
α Pegasi	20	23	14.5	51	49	10
	20	24	54.8	52	30	10
Polaris	20	26	56.9	70	48	20
	20	28	01.1	70	48	00
	20	28	52.4	70	48	30
	20	29	47.1	70	49	50
	20	30	28.9	70	50	00
	20	31	14.2	70	50	30
	20	31	58.1	70	50	20
	20	32	39.9	70	52	00
	20	33	17.2	70	51	40
	20	33	59.0	70	52	10
	20	35	14.8	70	53	10

Index error —11′ 30″. Barometer 28.468 in. Thermometer 74°.

CAMP No. 32—September 1, 1853.

Arcturus	19	49	45.4	79	05	20
	19	50	33.9	78	45	20
	19	52	12.1	78	05	40
	19	52	48.0	77	51	20
	19	53	19.6	77	38	20
	19	54	04.1	77	20	00
	19	54	55.0	76	59	30
α Cygni	19	57	18.9	117	25	30
	19	58	04.3	117	41	50
	19	58	48.2	117	58	00
	19	59	32.5	118	13	20
	20	00	23.4	118	31	40
α Coronæ Borealis	20	04	46.6	111	56	10
	20	05	57.0	111	28	10
	20	06	40.9	111	09	50
	20	07	37.2	110	47	00
	20	08	42.2	110	20	30
Polaris	20	11	03.1	70	45	30
	20	11	52.5	70	46	00
	20	12	44.6	70	46	50
	20	13	23.2	70	47	00
	20	14	02.3	70	47	50
	20	14	59.0	70	48	20
	20	15	38.9	70	48	40
	20	16	14.7	70	49	40
	20	17	15.6	70	50	10

CAMP No. 32—September 1, 1853—Continued.

Objected observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Pegasi	20	56	11.0	64	56	00
	20	57	37.4	65	26	20
	20	58	22.8	65	44	20
	20	59	44.5	66	17	10
	21	00	32.2	66	36	10
	21	01	16.1	66	54	00
	21	02	09.6	67	16	00

Index error —11′ 20″. Barometer, 28.261 in. Thermometer, 74°.5.

CAMP No. 33—September 2, 1853.

α Cygni	19	58	52.4	117	43	30
	19	59	48.1	118	04	10
	20	00	59.5	118	29	00
	20	01	45.9	118	45	00
	20	02	38.6	119	03	50
	20	03	49.4	119	27	50
α Coronæ Borealis	20	08	08.2	110	58	30
	20	09	11.4	110	32	00
	20	09	55.1	110	15	30
	20	10	44.5	109	54	10
	20	11	21.8	109	38	40
	20	12	15.3	109	17	10
	20	12	57.0	109	00	50
Arcturus	20	14	25.9	69	26	20
	20	15	07.2	69	09	10
	20	15	36.8	68	57	40
	20	16	12.2	68	43	30
	20	16	50.3	68	28	10
Polaris	20	19	08.1	71	01	20
	20	20	09.0	71	01	20
	20	20	56.5	71	03	00
	20	21	31.9	71	03	30
	20	22	13.0	71	03	50
	20	23	08.9	71	04	00
	20	23	39.6	71	04	20
	20	24	18.0	71	05	00
	20	24	43.8	71	05	20
	20	25	11.7	71	05	50
	20	25	41.0	71	06	20

Index error —12′ 20″. Barometer, 28.438 in. Thermometer, 75°.

CAMP No. 34—September 3, 1853.

α Cygni	20	11	51.5	122	04	50
	20	12	29.9	122	18	20
	20	13	17.0	122	34	30
	20	13	56.2	122	48	20
	20	14	35.0	123	01	50
	20	15	20.3	123	17	50
	20	16	02.2	123	32	20

APPENDIX A—Continued.

CAMP No. 34—SEPTEMBER 3, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Coronæ Borealis	20	18	50.4	106	59	40
	20	19	43.0	106	38	10
	20	20	25.9	106	21	20
	20	21	20.1	105	59	30
	20	22	20.0	105	34	00
	20	23	08.0	105	14	40
	20	23	50.2	104	57	50
Arcturus	20	25	23.9	65	23	40
	20	26	10.4	65	04	00
	20	27	02.5	64	42	40
Polaris	20	29	24.4	71	19	10
	20	30	37.5	71	20	10
	20	31	36.0	71	21	00
	20	32	34.1	71	21	30
	20	33	13.9	71	22	40
	20	34	15.6	71	22	50
	20	35	07.8	71	23	20
	20	36	06.3	71	24	20
	20	36	54.5	71	25	00

Index error —12′. Barometer, 27.912 in. Thermometer, 77°.5.

CAMP No. 35—SEPTEMBER 4, 1853.

Arcturus	20	53	43.4	54	16	10
	20	54	25.2	53	58	30
	20	55	06.3	53	42	10
	20	55	50.6	53	24	00
	20	56	32.4	53	07	30
	20	57	15.0	52	50	10
	20	57	57.9	52	35	50
α Pegasi	21	01	31.8	65	55	10
	21	02	44.0	66	24	20
	21	03	26.6	66	41	50
	21	04	20.3	67	03	00
	21	06	27.9	67	54	20
	21	07	26.0	68	18	00
	21	08	14.0	68	37	20
Polaris	21	11	27.1	71	59	00
	21	12	19.0	71	59	40
	21	13	10.2	72	01	00
	21	13	43.0	72	01	20
	21	14	43.9	72	02	10
	21	15	19.3	72	02	30
	21	16	03.1	72	03	10
	21	16	33.4	72	03	30
	21	17	01.9	72	03	50
	21	17	39.5	72	04	10
α Coronæ Borealis	21	26	35.4	79	58	10
	21	27	43.6	79	30	30
	21	29	09.0	78	56	50

Index error — 12′. Barometer, 27.788 in. Thermometer, 72°.

CAMP No. 35—SEPTEMBER 5, 1853.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Arcturus	20	46	15.6	57	17	10
	20	46	59.4	57	00	20
	20	47	55.5	56	37	10
	20	48	46.0	56	17	00
	20	49	21.9	56	02	10
	20	50	00.0	55	47	10
	20	50	48.1	55	28	30
α Pegasi	20	53	55.0	62	47	50.
	20	55	40.1	63	31	20
	20	56	23.9	63	48	20
	20	57	38.2	64	17	40
	20	58	44.8	64	45	30
	20	59	37.6	65	06	30
	21	00	36.2	65	29	50
Polaris	21	02	29.5	71	52	30
	21	03	47.0	71	54	00
	21	05	01.9	71	54	10
	21	05	54.6	71	54	50
	21	06	55.0	71	56	00
	21	07	35.7	71	56	10
	21	08	07.0	71	56	50
	21	08	45.8	71	57	30
	21	09	43.9	71	58	20
	21	10	29.1	71	58	40
	21	11	24.0	71	59	40
	21	12	32.9	72	00	00

Index error — 12′ 30″. Barometer, 27.908 in. Thermometer 72°.5.

CAMP No. 36—SEPTEMBER 6, 1853.

α Coronæ Borealis	21	05	10.0	89	05	00
	21	05	52.1	88	48	10
	21	06	31.4	88	31	40
	21	07	15.2	88	14	50
	21	07	54.8	87	58	40
	21	08	49.6	87	36	50
	21	09	28.1	87	31	40
Polaris	21	11	13.4	71	54	00
	21	12	03.2	71	56	30
	21	13	00.9	71	56	50
	21	13	46.4	71	57	10
	21	14	33.1	71	58	30
	21	15	09.0	71	58	40
	21	16	08.9	71	59	20
	21	17	31.1	72	00	00
	21	18	22.0	72	00	40
	21	19	19.0	72	01	20
α Pegasi	21	36	10.1	79	14	00
	21	37	49.2	79	53	30
	21	39	07.0	80	24	30
	21	40	01.6	80	45	50
	21	40	35.9	80	59	50
	21	41	30.0	81	20	30
	21	42	18.1	81	39	20
	21	43	12.3	82	01	20

Index error — 12′ 30″. Barometer, 27.898 in. Thermometer 64°.

APPENDIX A—Continued.

CAMP No. 37—September 7, 1853.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
a Pegasi	21	46	37.0	84	22	50
	21	47	35.1	84	50	00
a Coronæ Borealis	21	52	20.6	69	09	40
	21	53	10.1	68	48	50
	21	54	20.9	68	21	30
	21	55	54.2	67	44	30
	21	57	03.1	67	17	10
	21	57	58.3	66	55	00
	21	58	47.8	66	35	30
Polaris	22	00	43.9	72	40	00
	22	01	29.4	72	40	00
	22	02	55.5	72	41	40
	22	04	03.2	72	42	00
	22	05	00.0	72	43	40
	22	05	52.8	72	43	40
	22	06	47.5	72	45	00
	22	07	29.4	72	45	10
	22	07	59.1	72	45	10
	22	08	44.0	72	45	40
	22	09	25.8	72	46	20

Index error — 12′ 30″. Barometer, 27.78 in. Thermometer, 61°.

CAMP No. 38—September 8, 1853.

Jupiter	20	02	44.4	59	55	00
Moon's lower limb	20	03	39.8	52	05	00
Dist. between Jupiter and Moon's W. limb.	20	04	40.2	17	34	20
	20	05	40.1	17	34	10
	20	06	44.0	17	33	50
Moon's lower limb	20	07	21.3	51	12	30
Jupiter	20	08	18.9	59	15	50
Moon's lower limb	20	11	18.2	50	15	40
Dist. between Moon's W. limb & Venus.	20	14	45.0	41	07	50
	20	15	38.1	41	08	40
	20	16	12.2	41	08	50
	20	17	06.6	41	09	40
Moon's lower limb	20	18	06.4	48	36	00
Moon's lower limb	20	48	15.4	40	36	50
Altair	20	50	11.0	119	35	30
Dist. between Moon's W. limb & Altair.	21	01	36.1	64	48	10
	21	02	36.3	64	48	00
	21	03	35.9	64	47	20
Altair	21	05	35.4	122	13	30
Moon's lower limb	21	06	08.3	35	10	50
a Pegasi	21	25	11.2	75	20	00
	21	27	20.0	76	12	20
	21	29	18.4	76	58	40
	21	30	17.0	77	22	20
	21	31	43.3	77	56	40
	21	32	34.1	78	18	00
	21	33	19.6	78	35	10
	21	34	16.2	78	57	00
	21	35	23.0	78	24	00
Polaris	21	11	48.0	72	11	20
	21	12	26.9	72	12	20
	21	13	13.1	72	12	40
	21	13	48.5	72	12	50
	21	42	08.1	72	35	20

CAMP No. 38—September 8, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h	*m.*	*s.*	°	′	″
Polaris	21	42	54.4	72	35	00
	21	43	48.9	72	36	00
	21	44	22.6	72	36	10
	21	45	14.3	72	37	30
	21	45	53.8	72	37	40
a Coronæ Borealis	21	17	51.3	83	30	20
	21	18	42.0	83	09	20
	21	19	39.9	82	46	00
	21	21	06.6	82	10	30
	21	21	56.8	81	50	50
	21	22	45.0	81	31	30
	21	23	36.7	81	10	30

Index error — 12′ 30″. Barometer, 27.672 in. Thermometer, 64°.

CAMP No. 39—September 9, 1853.

Moon's lower limb	21	04	22.4	45	45	00
Altair	21	06	07.9	122	09	20
Dist. between Moon's W. limb & Altair.	21	09	24.6	53	53	20
	21	10	18.8	53	52	00
	21	10	55.1	53	52	30
Altair	21	12	30.8	123	01	30
Moon's lower limb	21	13	55.3	43	38	20
a Coronæ Borealis	21	16	46.9	64	57	50
	21	18	38.6	64	12	50
	21	19	11.2	63	59	00
	21	19	50.3	63	44	00
Polaris	21	21	23.1	72	16	50
	21	21	57.0	72	17	50
	21	22	38.2	72	18	10
	21	23	12.9	72	18	50
	21	23	39.6	72	19	10
a Pegasi	21	25	55.5	75	15	00
	21	26	38.1	75	31	20
	21	27	33.3	76	52	00
	21	28	24.5	76	14	20
	21	29	02.4	76	29	50

Index error — 12′ 30″. Barometer, 27.69 in. Thermometer, 66°.8.

CAMP No. 40—September 10, 1853.

Moon's lower limb	21	29	23.3	49	06	10
a Pegasi	21	30	38.0	76	46	10
	21	32	04.9	77	19	50
Dist. between Moon's lower limb & *a* Pegasi.	21	34	54.4	85	13	50
	21	35	56.1	85	12	30
	21	37	37.3	85	11	00
a Pegasi	21	39	47.1	80	23	00
Moon's lower limb	21	41	03.0	47	11	30

APPENDIX A—Continued.

CAMP No. 40—September 10, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Coronæ Borealis	21	44	19.8	64	20	00
	21	44	54.9	64	07	30
	21	45	40.6	63	49	10
	21	46	40.5	63	25	10
	21	47	27.0	63	07	10
	21	48	44.4	62	26	30
	21	49	18.0	62	23	00
α Andromedæ	21	54	56.2	74	44	10
	21	56	21.9	75	18	30
	21	57	04.3	75	35	00
	21	57	37.9	75	49	20
	21	58	30.0	76	09	40
	21	59	25.4	76	31	50
	22	00	07.2	76	48	10
Polaris	22	01	24.0	72	40	30
	22	02	20.1	72	41	30
	22	02	53.0	72	41	40
	22	03	27.5	72	42	10
	22	04	12.6	72	42	50
	22	04	59.3	72	43	10
	22	05	53.1	72	44	10

Index error — 12′ 30″. Barometer, 27.552 in. Thermometer, 73°.8.

CAMP No. 41—September 11, 1853.

Moon's lower limb	21	22	11.0	55	30	00
Jupiter	21	23	25.4	46	51	10
Dist. between Moon's W. limb and Jupiter.	21	24	29.6	25	46	30
	21	26	07.1	25	46	20
	21	27	28.3	25	47	20
	21	28	24.6	25	47	40
Jupiter	21	29	34.4	45	25	00
Moon's lower limb	21	30	34.5	55	05	50
α Pegasi	21	31	47.0	76	44	30
Dist. between Moon's W. limb and α Pegasi.	21	37	58.2	72	24	50
	21	43	09.9	72	22	50
	21	44	55.0	72	22	20
	21	44	55.0	72	21	20
α Pegasi	21	49	31.2	83	48	00
Moon's lower limb	21	50	44.6	53	40	00
α Coronæ Borealis	21	53	32.4	70	27	40
	21	54	20.0	70	08	50
	21	55	11.3	69	48	00
	21	56	32.0	69	16	00
	21	57	07.4	69	01	10
	21	57	57.5	68	43	00
	21	58	51.0	68	21	30
α Andromedæ	22	01	46.5	76	54	50
	22	02	25.8	77	10	10
	22	02	54.4	77	22	40
	22	03	34.3	77	37	00
	22	04	19.8	77	56	00
	22	05	22.4	78	19	50
	22	05	56.0	78	33	40

CAMP No. 41—September 11, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	22	08	34.9	72	28	00
	22	09	54.2	72	28	20
	22	11	41.9	72	29	20
	22	12	25.9	72	30	10
	22	13	11.0	72	31	20
	22	13	47.8	72	31	30
	22	15	01.0	72	33	00
	22	15	51.6	72	33	00
	22	16	34.4	72	33	10
	22	17	31.3	72	34	20

Index error — 12′ 30″. Barometer, 27.362 in. Thermometer, 76°.5.

CAMP No. 42—September 12, 1853.

Moon's lower limb	20	51	49.0	53	55	20
Jupiter	20	52	37.9	53	49	30
Distance between Moon's W. limb and Jupiter.	20	54	25.0	39	31	00
	20	55	14.6	39	30	50
	20	57	44.4	39	31	10
	20	58	32.3	39	31	50
	20	59	20.0	39	32	20
Jupiter	21	00	41.4	52	16	40
Moon's lower limb	21	01	53.5	55	03	30
α Pegasi	21	05	44.9	65	52	10
Distance between Moon's W. limb and α Pegasi.	21	09	50.2	60	06	10
	21	10	59.4	60	06	40
	21	12	08.8	60	04	50
	21	13	08.1	60	05	30
α Pegasi	21	17	34.4	70	40	10
Moon's lower limb	21	18	44.6	56	35	10
α Cornæ Borealis	21	22	11.2	83	24	10
	21	23	16.1	82	59	10
	21	23	54.6	82	41	50
	21	24	37.0	82	24	40
	21	25	19.9	82	08	30
α Pegasi	21	28	08.1	74	55	20
	21	29	27.0	75	27	00
	21	30	03.8	75	41	40
	21	30	44.2	75	58	40
	21	31	48.0	76	23	00
Polaris	21	33	52.2	71	42	40
	21	34	34.9	71	44	00
	21	35	05.7	71	44	10
	21	35	33.1	71	44	10
	21	35	56.9	71	44	20
	21	36	28.5	71	44	30
	21	36	56.8	71	45	30
	21	37	32.6	71	46	20
	21	38	00.4	71	47	10

Index error — 12′ 30″. Barometer 26.96 in. Ther. 72°.6.

APPENDIX A—Continued.

CAMP No. 42—September 13, 1853.

Object observed.	Time of observat'n by chronometer. h.	m.	s.	Observed double altitude. °	′	″
Moon's lower limb	21	34	48.0	56	09	10
Jupiter	21	35	50.5	44	34	50
Distance between Moon's W. limb and Jupiter.	21	37	01.3	53	36	30
	21	38	11.9	53	36	10
	21	39	42.1	53	36	40
	21	40	26.4	53	37	00
	21	41	04.0	53	37	10
Jupiter	21	42	08.4	43	01	50
Moon's lower limb	21	43	05.6	57	24	10
α Pegasi	21	45	11.0	81	39	00
Distance between Moon's W. limb and α Pegasi.	21	47	26.1	48	04	20
	21	49	06.3	48	04	00
	21	50	38.2	48	02	50
α Pegasi	21	52	04.8	83	23	10
Moon's lower limb	21	52	54.2	58	44	40
α Cornæ Borealis	21	55	45.4	70	00	00
	21	57	10.9	69	25	10
	21	57	45.0	69	11	50
	21	58	27.8	68	54	20
	21	59	06.2	68	40	00
	21	59	42.3	68	25	10
	22	00	30.3	68	06	00
α Andromedæ	22	01	50.6	76	24	20
	22	02	34.1	76	41	10
	22	03	57.7	77	14	30
	22	04	39.4	77	31	40
	22	05	47.4	77	59	00
	22	06	40.5	78	20	30
	22	07	15.2	78	33	50
Polaris	22	08	54.1	72	09	10
	22	09	37.0	72	10	30*d*
	22	10	24.4	72	10	30
	22	11	05.2	72	10	40
	22	11	43.4	72	11	50
	22	12	14.5	72	12	20
	22	12	48.1	72	12	30
	22	13	12.9	72	13	00
	22	13	37.4	72	13	30
	22	14	04.4	72	13	50
	22	18	44.5	72	20	20
	22	20	19.2	72	18	50
	22	21	33.7	72	16	50
	22	22	51.4	72	16	00

Index error — 12′ 30″. Barometer 26.85 in. Ther. 70°.5.

CAMP No. 43—September 14, 1853.

Object observed.	Time of observat'n by chronometer. h.	m.	s.	Observed double altitude. °	′	″
α Cornæ Borealis	20	48	28.1	97	27	10
	20	49	18.6	97	08	10
	20	50	09.2	96	46	50
	20	50	48.0	96	30	40
	20	51	22.6	96	16	30
	20	52	25.4	95	51	10
	20	53	03.9	95	35	30

CAMP No. 43—September 14, 1853—Continued.

Object observed.	Time of observat'n by chronometer. h.	m.	s.	Observed double altitude. °	′	″
Moon's lower limb	20	54	22.0	40	19	10
Jupiter	20	57	03.2	53	39	00
Distance between Moon's W. limb and Jupiter.	20	59	19.8	66	59	30
	21	00	48.0	66	59	10
	21	01	43.4	67	00	10
Jupiter	21	02	45.7	52	33	10
Moon's lower limb	21	03	43.0	42	59	40
α Pegasi	21	08	03.8	66	28	20
	21	09	02.2	66	50	30
Distance between Moon's W. limb and α Pegasi.	21	10	46.3	37	39	20
	21	11	36.5	37	38	40
	21	12	38.4	37	38	00
α Pegasi	21	15	20.9	69	24	10
Moon's lower limb	21	16	37.4	46	33	20
Polaris	21	20	35.5	71	09	00
	21	21	17.1	71	09	00
	21	21	53.0	71	09	40
	21	22	24.3	71	10	00
	21	22	51.9	71	10	10
	21	23	21.0	71	10	30
	21	23	58.3	71	11	00
	21	24	31.4	71	11	30
	21	24	59.9	71	11	50
Pegasi	21	29	46.2	75	12	00
	21	32	42.6	76	23	00
	21	33	13.4	76	35	00
	21	33	50.9	76	49	50
	21	34	22.9	77	03	10
	21	35	12.0	77	23	00
	21	36	13.5	77	47	30

Index error — 12′. Barometer 26.722 in. Ther. 78°.3.

CAMP No. 44—September 15, 1853.

Object observed.	Time of observat'n by chronometer. h.	m.	s.	Observed double altitude. °	′	″
α Coronæ Borealis	21	39	04.2	77	28	30
	21	39	38.7	77	10	10
	21	40	25.5	76	55	00
	21	41	33.6	76	27	00
	21	42	26.0	76	06	50
α Pegasi	21	45	03.4	80	51	00
	21	45	43.1	81	08	10
	21	46	21.0	81	22	40
	21	46	52.8	81	35	40
	21	47	31.2	81	50	10
	21	48	02.3	82	03	30
Polaris	21	49	53.1	71	24	00
	21	50	36.5	71	24	00
	21	51	15.0	71	24	10
	21	51	52.2	71	24	20
	21	52	41.7	71	25	00
	21	53	17.4	71	25	30

APPENDIX A—Continued.

CAMP. No. 44—SEPTEMBER 15, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Altair (latitude)	21	57	47.0	126	23	50
	21	58	21.9	126	23	10
	21	58	64.1	126	23	10
	21	59	23.2	126	21	50

Index error — 12′ 30″. Barometer 26.578 in. Thermometer 72°.5.

CAMP No. 45—SEPTEMBER 16, 1853.

α Coronæ Borealis	21	17	56.2	86	33	00
	21	18	40.0	86	15	20
	21	19	16.4	86	00	20
	21	19	59.0	85	43	00
	21	20	33.5	85	29	00
α Pegasi	21	37	21.3	77	38	10
	21	39	51.9	78	14	00
	21	46	36.6	78	31	20
	21	41	12.2	78	45	40
	21	42	42.7	79	09	30
Altair	21	43	53.2	126	21	30
	21	44	54.6	126	24	00
	21	46	20.1	126	25	20
	21	47	49.5	126	28	20
	21	48	46.6	126	30	20
Altair (latitude)	21	49	44.6	126	31	30
	21	50	21.2	126	33	00
	21	51	27.3	126	33	40
	21	52	23.1	126	34	00
	21	53	17.9	126	34	00
	21	54	23.8	126	34	00
	21	54	54.0	126	34	10
	21	55	19.4	126	34	20
	21	56	25.0	126	33	20
	21	57	17.2	126	31	40
	21	58	00.4	126	32	40
	21	58	48.4	126	30	40
	22	00	05.9	126	30	30
	22	00	46.0	126	29	30
Polaris	22	03	55.9	71	28	00
	22	04	55.0	71	28	40
	22	05	27.1	71	29	20
	22	06	01.6	71	29	40
	22	06	34.1	71	30	00
	22	07	02.3	71	30	30
	22	07	26.5	71	30	40

Index error — 12′. Barometer 26.176 in. Thermometer 72°.5.

CAMP No. 46—SEPTEMBER 17, 1853.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Serpentis	22	43	49.6	86	18	20
	22	44	52.3	85	54	40
	22	45	38.0	85	36	10
	22	46	22.6	85	18	50
	22	47	06.5	85	02	30
α Andromedæ	22	50	50.6	93	53	40
	22	51	32.3	94	10	30
	22	52	11.8	94	26	30
	22	52	50.9	94	42	00
	22	53	32.3	94	59	20
Polaris	22	55	48.3	71	59	50
	22	58	19.0	72	01	50
	22	59	23.2	72	02	10
	23	00	04.8	72	02	40
	23	02	01.6	72	04	00
	23	02	28.5	72	04	10

Index error — 12′. Barometer 25.944 in. Thermometer 75°.

CAMP No. 47—SEPTEMBER 19, 1853.

α Coronæ Borealis	21	11	30.9	90	28	40
	21	12	39.0	90	01	10
	21	14	50.3	89	08	30
	21	15	23.1	88	54	50
	21	16	04.0	88	38	00
	21	16	35.6	88	25	30
	21	17	14.5	88	09	10
α Pegasi	21	19	46.6	68	52	40
	21	20	59.0	69	21	40
	21	21	45.8	69	41	20
	21	22	17.2	69	54	10
	21	23	00.4	70	11	50
	21	23	37.1	70	26	10
	21	24	47.7	70	55	10
Polaris	21	26	17.6	70	31	10
	21	27	03.9	70	32	00
	21	27	54.9	70	33	10
	21	29	06.8	70	33	50
	21	29	30.0	70	34	10
	21	30	10.9	70	34	40
	21	30	43.0	70	35	00
Altair (latitude)	21	35	48.8	126	03	00
	21	37	08.6	126	11	00
	21	38	39.4	126	19	20
	21	39	57.0	126	24	40
	21	41	14.1	126	28	30
	21	42	47.8	126	35	30
	21	43	49.0	126	37	30
	21	45	03.9	126	37	40

Index error — 14′. Barometer, 26.28 in. Thermometer, 65°.5.

APPENDIX A—Continued.

CAMP No. 49—September 21, 1853.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
a Coronæ Borealis	21	51	38.1	75	27	00
	21	52	19.0	75	09	40
	21	53	01.8	74	52	20
	21	53	38.3	74	37	50
	21	54	17.2	74	21	40
	21	54	59.1	74	05	30
	21	55	42.7	73	48	20
a Andromedæ	21	58	54.9	71	03	20
	22	00	35.0	71	43	10
	22	01	15.8	71	59	10
	22	03	24.0	72	51	30
	22	04	17.0	73	12	00
Polaris	22	06	26.6	70	49	50
	22	07	22.4	70	50	10
	22	08	16.1	70	51	20
	22	08	49.9	70	51	40
	22	09	31.0	70	52	50
	22	10	28.2	70	53	10
	22	11	14.8	70	53	30
	22	15	24.1	70	56	10
	22	17	50.2	70	58	10
	22	19	29.4	70	59	50
	22	21	23.0	71	00	20

Index error — 14′. Barometer, 26.086 in. Thermometer, 55°.

CAMP No. 50—September 22, 1853.

a Coronæ Borealis	22	20	02.9	64	38	50
	22	21	08.9	64	12	50
	22	22	06.0	63	49	50
	22	22	41.1	63	34	40
	22	23	31.6	63	14	10
	22	24	08.5	63	00	20
	22	24	44.4	62	46	40
y Pegasi	22	27	16.5	66	40	00
	22	27	55.3	66	55	30
	22	28	36.1	67	13	00
	22	29	10.4	67	26	50
	22	30	03.2	67	48	20
	22	30	49.5	68	06	50
	22	31	32.0	68	24	40
Polaris	22	23	28.4	71	11	30
	22	35	02.0	71	14	00
	22	36	35.9	71	15	00
	22	37	32.5	71	16	10
	22	38	10.0	71	16	20
	22	38	46.2	71	16	20
	22	39	34.1	71	17	00

Index error — 14′. Barometer, 25.796 in. Thermometer, 69°.5.

CAMP No. 51—September 23, 1853.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
a Coronæ Borealis	22	11	00.4	68	46	10
	22	11	40.3	68	30	00
	22	12	16.0	68	16	10
	22	12	40.2	68	04	50
	22	13	23.1	67	49	20
	22	13	59.0	67	34	40
	22	14	38.9	67	18	30
y Pegasi	22	18	42.0	62	38	10
	22	19	46.5	63	04	20
	22	21	06.1	63	37	50
	22	29	19.1	64	06	30
	22	23	35.6	64	37	50
	22	24	30.9	64	59	30
	22	25	08.0	65	15	30
Polaris	22	28	26.1	71	05	40
	22	29	06.0	71	05	40
	22	29	40.0	71	06	30
	22	30	22.2	71	06	40
	22	30	48.9	71	07	10
	22	31	19.1	71	07	20
	22	32	12.9	71	07	40
	22	33	40.5	71	08	20
	22	34	41.0	71	09	50
	22	35	38.4	71	10	30
	22	36	36.1	71	11	00

Index error — 14′. Barometer, 25.422 in. Thermometer, 57°.1.

CAMP No. 52—September 24, 1853.

Areturus	21	19	54.0	50	52	30
	21	20	42.1	50	53	00
	21	21	14.9	50	19	50
	21	21	40.4	50	09	20
	21	22	10.3	49	57	10
a Coronæ Borealis	21	24	44.2	87	52	40
	21	25	23.5	87	35	30
	21	25	57.9	87	22	30
	21	26	28.1	87	10	10
	21	27	02.0	86	56	50
a Andromedæ	21	29	11.4	57	48	00
	21	29	56.1	58	06	20
	21	30	35.0	58	21	00
	21	31	10.9	58	35	10
	21	31	51.0	58	50	30
	21	32	28.4	59	05	20
Altair (latitude)	21	57	33.1	126	53	50
	21	58	19.0	126	54	10
	21	58	52.5	126	55	00
	21	59	31.3	126	56	10
	22	00	45.0	126	57	50
	22	01	44.5	126	58	00
	22	02	20.2	126	58	30
	22	02	59.6	126	58	50
	22	03	53.0	126	59	30
	22	04	36.4	126	59	10
	22	05	19.8	126	59	10

APPENDIX A—Continued.

CAMP No. 52—SEPTEMBER 24, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Altair (latitude)	22	05	51.0	126	59	10
	22	06	35.9	126	58	40
	22	07	10.5	126	58	10
	22	07	49.0	126	57	50
	22	08	24.9	126	57	00
	22	09	02.0	126	56	50
	22	10	00.0	126	55	20
	22	10	41.6	126	54	00
	22	11	34.4	126	53	30
	22	12	36.5	126	51	00
α Pegasi	22	15	29.0	88	29	10
	22	16	49.2	89	00	50
	22	17	51.1	89	24	50
	22	18	27.3	89	40	30
	22	19	06.9	89	56	20
Polaris	22	21	21.0	71	06	50
	22	22	15.1	71	07	00
	22	22	55.0	71	07	30
	22	23	56.9	71	08	40
	22	24	41.3	71	09	20
	22	26	06.4	71	09	50
	22	26	40.5	71	11	00

Index error — 14′. Barometer, 25.352 in. Thermometer, 55°.9.

CAMP No. 52—SEPTEMBER 25, 1853.

α Coronæ Borealis	21	49	02.0	78	01	50
	21	49	58.6	77	38	30
	21	50	34.4	77	24	10
	21	51	16.2	77	07	20
	21	51	57.7	76	50	50
α Pegasi	21	53	44.0	79	48	20
	21	54	28.5	80	06	40
	21	55	04.6	80	19	50
	21	55	37.3	80	34	00
	21	56	08.0	80	46	40

Index error — 14′. Barometer, 28.324 in. Thermometer, 57°.5.

CAMP No. 54, (*Anton Chico*)—SEPTEMBER 28, 1853.

α Coronæ Borealis	22	23	03.4	65	13	50
	22	23	51.3	64	53	20
	22	24	29.5	64	38	10
	22	25	11.1	64	22	10
	22	25	47.2	64	07	50
α Pegasi	22	27	12.2	92	15	10
	22	27	47.1	92	28	30
	22	28	20.6	92	41	20
	22	28	57.0	92	55	20
	22	29	30.8	93	08	50
	22	30	04.0	93	21	30

CAMP No. 54, (*Anton Chico*)—SEPTEMBER 28—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	22	32	51.7	71	23	50
	22	33	42.2	71	24	50
	22	34	17.4	71	25	40
	22	34	59.1	71	25	40
	22	35	31.4	71	25	50
	22	36	08.5	71	26	40
	22	36	44.4	71	27	00

Index error — 13′. Barometer, 24.916 in. Thermometer, 56°.5.

CAMP No. 55—SEPTEMBER 29, 1853.

Polaris	23	41	58.0	72	15	00
	23	43	31.7	72	16	00
	23	44	36.0	72	16	50
	23	45	34.1	72	17	50
	23	46	46.6	72	18	40
	23	48	07.2	72	19	10
	23	49	08.4	72	19	30

Index error — 13′ 50″. Barometer, 24.006 in. Thermometer, 58°.

CAMP No. 57—OCTOBER 1, 1853.

α Coronæ Borealis	22	44	49.9	58	11	00
	22	46	32.4	57	33	20
	22	47	54.3	57	00	00
	22	49	06.6	56	29	10
	22	50	35.7	55	54	50
α Pegasi	23	24	47.3	96	46	10
	23	27	18.1	97	47	30
	23	28	58.0	98	21	30
Polaris	23	18	21.9	71	24	00
	23	20	04.3	71	28	00
	23	21	53.1	71	31	30

Index error — 13′ 50″. Barometer, 24.022 in. Thermometer, 42°.1.

CAMP No. 58, (*San Antonio*)—OCTOBER 2, 1853.

α Coronæ Borealis	22	47	57.9	57	22	40
	22	49	20.0	56	48	50
	22	50	38.2	56	18	10
	22	51	42.3	55	54	10
	22	52	48.3	55	27	10
α Pegasi	22	59	00.0	86	51	50
	23	00	38.9	87	32	10
	23	02	03.3	88	03	30
	23	03	12.1	88	28	50
	23	04	58.1	89	11	10

APPENDIX A—Continued.

CAMP No. 58, (*San Antonio*)—October 2, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	23	10	43.0	71	38	00
	23	11	47.9	71	38	00
	23	13	35.1	71	41	10
	23	15	07.8	71	42	00
	23	16	23.1	71	42	00

Index error — 12′ 40″. Barometer, 23.888 in. Thermometer, 44°.7.

CAMP No. 59, (*Albuquerque*)—October 3, 1853.

α Pegasi	22	51	20.6	99	05	30
	22	54	14.7	100	09	10
	22	55	21.5	100	35	00
	22	56	04.3	100	55	00
	22	57	11.9	101	21	10
Polaris	23	02	07.4	71	31	00
	23	11	03.0	71	36	00
	23	12	13.1	71	36	50
	23	12	56.1	71	37	00
	23	14	20.2	71	38	30
	23	22	31.5	74	40	40
	23	23	38.8	74	13	50
	23	24	40.4	73	49	50
	23	25	42.2	73	29	00
	23	27	37.0	72	42	10

Index error — 12′ 40″. Barometer, 25.288 in. Thermometer, 53°.7.

CAMP No. 59, (*Albuquerque*)—October 4, 1853.

α Coronæ Borealis	22	17	02.2	70	11	30
	22	18	11.1	69	45	20
	22	19	09.6	69	22	30
	22	20	51.0	68	41	10
	22	21	42.1	68	20	10
α Pegasi	22	26	54.1	89	35	00
	22	28	02.2	90	03	20
	22	28	53.2	90	24	10
	22	30	16.5	90	54	30
	22	31	23.7	91	22	10
Polaris	22	35	20.6	71	10	00
	22	36	19.0	71	10	20
	22	37	20.1	71	10	40
	22	38	20.1	71	11	50
	22	39	49.3	71	12	30

Index error — 11′ 50″. Barometer, 25.26 in. Thermometer, 53°.7.

CAMP No. 59, (*Albuquerque*)—October 5, 1853.

α Andromedæ	23	12	16.0	95	39	50
	23	13	46.4	96	16	40
	23	14	32.2	96	34	50
	23	15	10.8	96	51	50
	23	16	24.3	97	21	40

CAMP No. 59, (*Albuquerque*)—October 5, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	23	18	23.8	71	41	00
	23	19	30.1	71	42	00
	23	20	04.6	71	43	00
	23	20	36.8	71	43	00
	23	21	10.0	71	43	20
	23	21	41.5	71	43	30
	23	22	17.8	71	43	50
	23	23	04.9	71	45	00
	23	23	40.5	71	45	00
α Lyræ	23	24	58.3	122	50	50
	23	25	49.2	122	30	20
	23	26	21.5	122	18	40
	23	27	13.4	121	58	00
	23	28	04.8	121	38	20

Index error — 13′. Barometer, 25,286 in. Thermometer, 63°.

CAMP No. 59—(*Albuquerque*)—October 6, 1853.

α Coronæ Borealis	22	20	21.2	68	57	50
	22	21	13.2	68	37	10
	22	22	58.9	67	54	00
	22	23	35.3	67	40	50
	22	24	22.5	67	21	20
α Andromedæ	22	26	07.9	76	54	50
	22	27	51.4	77	36	30
	22	28	33.4	77	53	50
	22	29	03.8	78	06	00
	22	30	00.6	78	29	00

Index error — 13′. Barometer, 25.184 in. Thermometer, 48°.1.

SEXTANT No. 3.—SIDEREAL CHRONOMETER No. 2,475, BY PARKINSON & FRODSHAM.

ISLETA, October 29, 1853.

α Andromedæ	8	39	50.5	93	30	40
	8	41	27.3	94	10	00
	8	42	49.6	94	43	20
	8	43	32.8	95	01	00
	8	44	17.5	95	19	20
α Pegasi	8	46	12.0	107	29	50
	8	47	52.5	108	07	00
	8	49	04.5	108	33	00
α Coronæ Borealis	8	51	02.8	45	27	00
	8	51	59.7	45	05	00
	8	52	51.0	44	44	30

APPENDIX A—Continued.

ISLETA, OCTOBER 29, 1853—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Lyræ	8	54	07.5	123	39	00
	8	54	53.4	123	21	00
	8	55	36.5	123	04	00
	8	56	20.6	122	47	00
	8	56	59.5	122	31	00
Polaris	8	59	46.4	71	10	00
	9	00	24.5	71	10	15
	9	01	01.4	71	11	10
	9	01	37.5	71	11	40
	9	02	23.7	71	12	20

Index error — 2′. Barometer 25.522 in. Thermometer 50°.

SEXTANT No. 2.—SIDEREAL CHRONOMETER No. 10, BY GLOVER.

CAMP. No. 61, (*south side of Isleta*)—NOVEMBER 9, 1853.

Saturn	1	45	51.1	54	15	10
	1	47	05.6	54	42	40
	1	48	18.1	55	12	20
	1	49	30.9	55	45	20
	1	50	37.1	56	09	40
α Lyræ	1	53	55.9	67	40	50
	1	55	11.2	67	12	30
	1	56	18.5	66	45	00
	1	57	23.1	66	19	55
	1	58	26.9	65	54	40

Index error — 11′ 50″. Barometer 25.348 in. Thermometer 39°.9.

CAMP No. 62, (*Rio Puerco*)—NOVEMBER 10, 1853.

Polaris	7	57	19.2	71	20	50
	8	03	40.2	71	17	00
	8	05	44.5	71	16	20
	8	07	16.6	71	15	00
Sirius	8	10	42.0	73	10	00
	8	12	20.9	73	23	00
	8	13	47.8	73	33	30
	8	14	56.0	73	43	00
	8	15	44.4	73	48	40
Saturn	8	20	20.5	117	49	30
	8	22	36.6	117	01	30
	8	23	48.4	116	33	00
	8	25	17.2	115	59	30

Index error — 13′. Barometer 24.838 in. Thermometer 22°.5.

CAMP. No. 63, (*Rio Rita*)—NOVEMBER 11, 1853.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Lyræ	2	36	16.0	52	56	40
	2	38	30.6	52	06	50
	2	39	21.5	51	51	10
	2	40	47.1	51	20	40
	2	41	48.6	50	59	20
Aldabaran	2	49	13.6	62	04	50
	2	50	01.7	62	24	30
	2	50	47.6	62	38	50
	2	51	18.5	62	55	40
	2	52	48.6	63	34	00
Fouralhaut	2	55	47.0	42	33	40
	2	56	57.6	42	22	10
	2	57	52.1	42	14	20
Polaris	3	26	17.1	73	13	40
	3	27	27.2	73	13	20
	3	28	16.9	73	13	00
	3	29	16.4	73	12	50
	3	30	06.8	73	12	30
	3	31	03.5	73	12	10

Index error — 12′ 30″. Barometer 24.6 in. Thermometer 34°.5.

CAMP No. 64, (*near Covera*)—NOVEMBER 14, 1853.

α Lyræ	1	25	29.4	102	46	30
	1	26	42.9	102	20	10
	1	27	06.5	102	09	00
	1	27	46.1	101	55	20
	1	28	35.5	101	37	30
	1	29	10.6	101	24	10
Saturn	1	46	51.2	53	45	50
	1	47	52.1	54	11	50
	1	48	46.0	54	32	40
	1	49	11.4	54	43	50
	1	50	01.2	55	04	00
Polaris	1	34	12.1	72	55	00
	1	35	25.9	72	55	30
	1	38	42.5	72	56	10
	1	40	55.5	72	57	00
	1	41	34.6	72	57	40
	1	42	14.6	72	57	50
	1	43	10.2	72	58	20
α Lyræ	1	53	07.0	68	55	00
	1	54	20.9	68	26	30
	1	55	53.9	67	50	00
	1	57	38.0	67	13	10
	1	58	06.8	67	04	30
	1	58	34.2	66	52	40

Index error—13′. Barometer 24.051 in. Ther. 49°.3.

APPENDIX A—Continued.

CAMP No. 65—NOVEMBER 15, 1853.

Object observed.	Time of observat'n by chronometer.	Observed double altitude.
	h. *m.* *s.*	° ′ ″
α Arietis	1 27 41.0	95 10 00
	1 28 25.5	95 27 30
	1 29 18.4	95 50 10
	1 30 21.5	96 14 20
	1 31 07.6	96 36 00
α Lyræ	1 32 56.5	76 41 20
	1 33 36.1	76 26 30
	1 34 30.8	76 07 00
	1 35 06.4	75 51 50
	1 35 44.9	75 39 20
	1 36 17.5	75 26 40
Polaris	1 46 24.9	72 59 00
	1 47 31.6	72 59 10
	1 48 35.5	72 59 20
	1 50 18.5	72 59 40
	1 51 09.6	72 59 50

Index error — 13′. Barometer 23.9 in. Ther. 35°.7.

CAMP No. 66, (*Sierra Madre*)—NOVEMBER 16, 1853.

Polaris	1 19 24.6	72 30 30
	1 20 18.1	72 31 10
	1 20 45.5	72 32 00
	1 21 53.5	72 32 20
	1 22 20.4	72 33 00
	1 23 17.5	72 33 44
α Lyræ	1 31 13.5	77 33 50
	1 32 09.6	77 13 30
	1 32 42.6	77 01 00
	1 33 14.5	76 50 00
	1 33 33.5	76 41 30
	1 34 04.6	76 31 00
Capella	1 38 13.5	47 07 00
	1 39 53.9	47 38 30
	1 41 24.8	48 06 30
	1 42 44.1	48 31 20
	1 43 33.5	48 46 30
	1 44 26.9	49 02 00

Index error — 13′. Barometer 23.2 in. Ther. 27°.5.

CAMP No. 67, (*Agua Fria*)—NOVEMBER 17, 1853.

Saturn	1 51 05.5	54 54 40
	1 54 55.5	56 27 10
	1 56 20.3	57 01 00
	1 57 17.7	57 24 20
	1 58 17.1	57 50 00
	1 59 32.2	58 20 30
	1 59 59.0	58 30 00
	2 00 49.5	58 51 30
	2 02 08.1	59 23 00

CAMP No. 67, (*Agua Fria*)—NOVEMBER 17, 1853—Cont'd.

Object observed.	Time of observat'n by chronometer.	Observed double altitude.
	h. *m.* *s.*	° ′ ″
Aldabaran	2 18 46.1	48 15 50
	2 19 42.1	48 38 50
	2 21 16.1	49 17 40
	2 23 20.4	50 08 50
	2 24 45.5	50 43 20
α Lyræ	2 07 27.1	64 27 00
	2 08 09.1	64 11 30
	2 08 36.2	64 02 10
	2 09 02.8	63 53 40
	2 09 37.1	63 40 40
Saturn	2 28 17.5	70 05 50
	2 29 00.6	70 23 30
	2 29 43.1	70 40 20
	2 30 22.6	70 56 40
	2 30 57.7	71 00 40
	2 31 34.5	71 26 30
α Aurigæ	2 34 00.0	64 56 40
	2 34 44.1	65 11 50
	2 35 19.2	65 23 00
	2 35 57.5	65 34 50
	2 36 25.5	65 44 50
α Cygni	2 48 36.1	97 26 20
	2 49 49.9	97 01 40
	2 50 37.1	96 44 40
	2 52 20.5	96 08 20
	2 53 11.4	95 50 00
	2 53 44.8	95 38 10
	2 55 47.9	94 53 50
Polaris	3 01 17.9	73 11 30
	3 03 11.1	73 12 00
	3 06 39.2	73 12 20
	3 12 01.4	73 12 40

Index error — 13′. Barometer, 22.594 in. Thermometer, 29°.5.

CAMP No. 68, (*Inscription Rock*)—NOVEMBER 18, 1853.

Polaris	1 36 18.5	72 48 40
	1 37 36.8	72 50 00
	1 39 33.1	72 50 30
	1 40 16.4	72 50 50
	1 42 26.2	72 51 30
α Lyræ	1 44 10.1	73 24 40
	1 44 42.5	73 13 50
	1 45 21.9	73 00 00
	1 46 01.1	72 45 20
	1 46 52.1	72 26 40
α Cygni	1 57 67.5	116 07 40
	1 58 01.8	115 49 20
	1 58 36.4	115 36 04
	1 59 09.5	115 24 40
	1 59 31.2	115 18 30
	2 00 05.7	115 04 30

APPENDIX A—Continued.

CAMP No. 68, (*Inscription Rock*)—Nov. 18, 1853—Cont'd.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Saturn	2	02	01.4	59	00	00
	2	02	36.5	59	12	40
	2	02	59.1	59	22	10
	2	03	49.5	59	42	00
	2	04	15.9	59	53	40
	2	04	51.1	60	09	00
Aurigæ	2	08	22.8	56	14	50
	2	09	02.5	56	27	10
	2	09	39.5	56	39	20
	2	10	25.3	56	55	10
	2	11	07.7	57	07	00
Polaris	2	12	22.9	73	02	50
	2	12	58.5	73	03	00
	2	13	35.4	73	03	10

Index error — 13′. Barometer, 23.075 in. Thermometer, 36°.2.

CAMP No. 69, (*Ojo del Piscado*)—November 19, 1853.

Polaris	1	12	44.0	72	46	40
	1	13	39.5	72	47	00
	1	14	49.9	72	47	20
	1	15	24.1	72	47	30
	1	16	05.5	72	48	00
	1	17	23.1	72	48	30
Lyræ	1	19	31.4	83	01	50
	1	20	09.1	82	48	10
	1	20	42.1	82	34	30
	1	21	03.5	82	26	20
	1	21	25.1	82	19	30
	1	21	55.5	82	08	30
Arietis	1	31	00.1	95	05	30
	1	31	34.5	95	21	00
	1	32	01.2	95	30	20
	1	32	54.6	95	53	40
	1	33	47.9	96	14	10
Saturn	1	46	53.0	52	30	50
	1	47	34.8	52	47	50
	1	47	46.5	52	57	40
	1	48	18.0	53	07	10
	1	48	42.2	53	15	40
	1	49	06.1	53	25	40
	1	49	24.2	53	34	00

Index error — 13′. Barometer 23.556 in. Thermometer, 28°.

CAMP No. 70, (*near Zuñi*)—November 21, 1853.

α Lyræ	1	33	41.5	78	04	00
	1	34	09.6	77	53	50
	1	34	33.0	77	43	50
	1	34	52.4	77	37	00
	1	35	20.8	77	27	50
	1	35	42.5	77	18	20
	1	36	11.1	77	08	10
	1	36	34.2	76	59	20
	1	37	00.9	76	47	20

CAMP No. 70, (*near Zuñi*)—November 21, 1853—Cont'd.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Cygni	1	39	10.5	123	11	30
	1	40	06.8	122	50	00
	1	40	50.5	122	37	20
	1	40	21.1	122	24	30
	1	41	44.5	122	17	10
	1	42	27.6	122	00	30
	1	42	50.8	121	52	40
	1	43	28.6	121	41	00
	1	44	12.5	121	24	30
	1	44	40.7	121	15	20
Polaris	1	47	19.5	72	58	10
	1	48	34.5	72	58	50
	1	49	24.6	72	59	30
	1	50	11.8	73	00	00
	1	50	57.2	73	00	30
	1	51	26.6	73	00	50
	1	52	07.5	73	00	50
	1	53	10.5	73	01	00
Saturn	1	56	21.2	56	13	40
	1	56	54.9	56	28	10
	1	57	33.9	56	44	33
	1	58	16.5	57	02	30
	1	59	06.9	57	22	10
	1	59	38.9	57	34	00
	2	00	19.6	57	51	40
α Aurigæ	2	01	51.0	53	36	30
	2	02	39.0	53	51	30
	2	03	15.6	54	02	30
	2	04	29.8	54	26	40
	2	05	53.9	54	53	50
	2	06	26.0	55	03	30

Index error — 13′ 30″. Barometer, 24.018 in. Thermometer, 32°.5.

CAMP No. 70, (*near Zuñi*)—November 22, 1853.

α Lyræ	1	49	33.0	72	13	10
	1	50	19.2	71	56	50
	1	51	40.9	71	27	30
	1	52	38.5	71	05	30
	1	53	42.6	70	42	10
	1	57	18.6	69	24	30
	2	00	42.8	68	10	40
Saturn	2	05	06.8	59	51	00
	2	06	21.6	60	21	20
	2	07	07.5	60	41	00
	2	08	02.4	61	03	40
	2	08	48.2	61	21	40
Polaris	2	11	27.5	73	06	50
	2	14	10.4	73	06	40
	2	15	45.1	73	06	10

Index error — 12′ 30″. Barometer 24 in. Thermometer 29°.8.

APPENDIX A—Continued.

CAMP No. 70, (*near Zuñi*)—NOVEMBER 23, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	0	56	36.50	72	34	40
	0	57	14.60	72	34	40
	0	57	45.70	72	34	50
	0	58	09.50	72	35	00
	0	58	34.70	72	35	20
	0	58	57.80	72	35	40
	0	59	18.00	72	35	50
	0	59	34.60	72	36	00
α Lyræ	1	01	35.0	90	09	30
	1	02	05.0	89	55	40
	1	02	29.1	89	50	00
	1	03	18.5	89	31	30
	1	03	37.5	89	22	10
	1	04	19.1	89	07	00
	1	04	42.4	88	50	20
	1	05	02.5	88	50	00
	1	05	19.4	88	44	50
	1	05	36.3	88	37	30
	1	05	55.1	88	30	40
α Cygni	1	07	12.1	111	28	20
	1	07	50.5	111	15	40
	1	08	20.9	111	05	00
	1	08	58.9	110	50	00
Saturn	1	11	39.9	38	16	10
	1	14	18.5	39	19	00
	1	14	51.4	39	24	00
	1	15	16.7	39	44	40
	1	15	45.1	39	56	30
	1	16	19.4	40	10	40
β Andromeda	1	25	48.8	124	20	00
	1	26	29.1	124	35	40
	1	26	56.5	124	46	40
	1	27	48.8	125	09	10
	1	28	28.9	125	24	20
	1	28	51.1	125	34	00
α Aurigæ	1	31	11.6	37	16	50
	1	32	34.6	37	40	30
	1	33	39.1	38	00	40
	1	35	51.5	38	50	50
	1	37	19.1	39	03	10

Index error —12′ 30″. Barometer 23.93 in. Thermometer 32°.5.

CAMP No. 70, (*near Zuñi*)—NOVEMBER 24, 1853.

Polaris	1	42	49.5	72	56	00
	1	43	35.6	72	56	20
	1	44	03.0	72	56	30
	1	44	31.0	72	56	10
	1	44	58.1	72	56	50
	1	45	19.6	72	57	00
	1	45	46.5	72	57	10

CAMP No. 70, (*near Zuñi*)—NOVEMBER 24, 1853—Cont'd.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Cygni	1	49	05.0	119	43	10
	1	49	33.5	119	34	00
	1	49	53.7	119	25	20
	1	50	16.5	119	19	00
	1	50	46.8	119	05	00
	1	51	06.9	119	00	00
α Lyræ	1	52	34.1	71	06	20
	1	52	54.4	70	59	30
	1	53	14.5	70	51	10
	1	53	33.0	70	44	20
	1	53	53.9	70	34	20
	1	54	11.5	70	29	10
	1	54	34.5	70	20	00
Saturn	1	56	23.0	56	32	30
	1	56	45.5	56	43	10
	1	57	02.2	56	49	50
	1	57	40.8	57	06	40
	1	58	27.9	57	27	30
	1	59	08.5	57	43	30
	1	59	26.0	57	50	00
α Aurigæ	2	01	40.5	46	29	50
	2	02	29.1	46	44	50
	2	03	02.3	46	54	40
	2	03	24.0	47	03	30
	2	03	43.6	47	09	10
	2	04	03.2	47	14	50

Index error — 12′ 40″. Barometer 23.964 in. Thermometer 36°.2.

CAMP No. 70, (*near Zuñi*)—NOVEMBER 25, 1853.

α Lyræ	1	45	36.5	73	41	10
	1	46	37.9	73	19	50
	1	47	32.6	72	59	40
	1	49	26.8	72	15	50
	1	50	42.3	71	47	30
	1	53	41.5	70	42	59
	1	56	22.6	69	48	20
	1	57	51.2	69	13	00
	1	59	15.5	68	36	30
Saturn	2	02	48.5	59	19	50
	2	05	02.1	60	12	00
	2	06	29.6	60	49	00
	2	07	38.3	61	16	20
	2	08	25.4	61	33	50
	2	09	33.5	62	02	20
	2	26	35.5	69	03	00
	2	29	19.8	70	12	20
	2	31	19.0	70	56	10
	2	33	34.3	71	55	20
	2	34	55.5	72	29	20
	2	37	40.0	73	34	30
	2	39	52.6	74	27	10

Index error —12′ 30″. Barometer 23.90 in. Ther. 21°.

APPENDIX A—Continued.

CAMP No. 72—November 28, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	1	13	28.0	72	33	50
	1	13	57.0	72	34	00
	1	14	21.8	72	34	10
	1	14	48.5	72	34	20
	1	15	07.6	72	34	30
	1	15	33.5	72	34	50
	1	16	09.1	72	35	00
α Lyræ	1	18	21.5	84	15	50
	1	19	08.9	83	58	00
	1	19	39.1	83	46	40
	1	20	01.4	83	38	50
	1	20	45.4	83	23	20
α Cygni	1	22	34.6	126	31	30
	1	23	21.3	126	14	50
	1	23	51.6	126	03	40
	1	24	22.6	125	52	30
	1	25	04.5	125	37	40
Saturn	1	28	12.5	45	01	10
	1	28	34.4	45	10	00
	1	28	50.2	45	18	20
	1	29	24.4	45	30	50
	1	29	43.7	45	38	30
	1	30	07.8	45	48	40
	1	30	28.0	45	56	00
α Aurigæ	1	33	29.1	44	13	30
	1	36	04.7	45	03	30
	1	43	17.6	46	57	40
	1	43	06.8	47	12	50
	1	44	01.3	47	30	00

Index error — 13′. Barometer 24 in. Ther. 31°.7.

CAMP No. 73—November 29, 1853.

Polaris	3	42	40.0	73	18	30
	3	43	27.2	73	18	40
	3	44	01.6	73	18	50
	3	44	36.8	73	18	50
	3	45	29.9	73	19	00
	3	46	02.1	73	19	00
	3	46	27.5	73	19	10
α Cygni	3	50	31.8	77	54	20
	3	51	25.4	77	36	20
	3	52	28.7	77	14	00
	3	53	06.2	77	02	20
	3	53	34.1	76	54	00
	3	54	10.1	76	40	00
α Tauri	3	57	34.2	86	04	00
	3	58	29.9	86	28	50
	3	58	59.5	86	38	30
	3	59	33.6	86	52	30
	4	00	06.4	87	05	50
	4	01	19.2	87	35	30

Index error — 13′. Barometer 24.322° in. Ther. 39°.

CAMP No. 74—November 30, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Altair	2	17	55.9	63	00	10
	2	18	34.9	62	44	50
	2	19	01.4	62	33	40
	2	19	28.5	62	22	20
	2	20	03.2	62	08	20
α Lyræ	2	21	24.9	61	46	50
	2	21	56.9	61	34	00
	2	22	43.8	61	18	10
	2	23	06.2	61	10	30
	2	23	36.9	61	00	00
Saturn	2	25	16.2	67	56	40
	2	26	07.9	68	06	30
	2	26	53.5	68	25	50
	2	27	25.7	68	40	00
	2	27	46.1	68	48	00
α Aurigæ	2	30	20.6	61	43	20
	2	30	49.3	61	52	50
	2	31	50.5	62	13	40
	2	32	22.3	62	22	50
	2	33	03.9	62	38	00
Polaris	2	35	26.2	73	13	20
	2	36	37.9	73	14	00
	2	38	01.0	73	14	50
	2	38	49.9	73	15	30
	2	40	02.8	73	15	50

Index error — 13′. Barometer, 24.68 in. Thermometer, 36°.

CAMP No. 75—December 1, 1853.

α Lyræ	2	11	35.4	65	40	20
	2	12	09.2	65	28	30
	2	12	37.2	65	18	20
	2	13	04.6	65	08	50
	2	13	25.7	65	00	20
Saturn	2	14	40.3	63	11	20
	2	15	15.4	63	25	40
	2	15	26.4	63	34	20
	2	16	11.1	63	48	20
	2	16	43.8	64	01	50
Polaris	2	18	20.2	73	10	00
	2	19	05.6	73	10	10
	2	19	48.5	73	10	20
	2	20	34.5	73	10	30
	2	21	20.1	73	10	40
α Pegasi	2	22	33.6	61	30	00
	2	23	09.1	61	16	00
	2	23	50.6	61	58	50
	2	24	17.9	61	48	00
	2	24	47.4	61	32	00

APPENDIX A—Continued.

CAMP No. 75—December 1, 1853—Continued.

Object observed.	Time of observ'n by chronometer.	Observed double altitude.
	h. *m.* *s.*	° ′ ″
α Aurigæ	2 26 05.4	60 04 40
	2 26 35.9	60 13 50
	2 27 14.5	60 26 40
	2 27 41.8	60 34 50
	2 28 09.9	60 44 40

Index error — 13′ 20″. Barometer, 24.68 in. Thermometer, 31°.

CAMP No. 76—December 2, 1853.

Polaris	2 15 26.4	73 00 00
	2 16 04.2	73 00 00
	2 16 34.7	73 00 20
	2 17 02.6	73 00 20
	2 17 24.7	73 00 20
	2 18 00.5	73 00 20
	2 18 28.9	73 00 30
	2 18 46.0	73 00 30
Saturn	2 20 40.3	65 30 00
	2 21 18.2	65 44 10
	2 21 46.6	65 55 00
	2 22 31.4	66 14 20
	2 23 40.0	66 43 10
α Lyræ	2 25 48.0	60 43 30
	2 26 32.9	60 27 10
	2 27 04.2	60 14 50
	2 27 35.4	60 03 50
	2 27 57.4	59 55 00
Altair	2 30 13.5	58 53 50
	2 30 50.1	58 30 00
	2 31 25.2	58 16 50
	2 31 52.2	58 04 00
	2 32 28.7	57 48 40
α Aurigæ	2 34 39.5	62 33 30
	2 35 10.5	62 42 40
	2 35 56.4	62 58 10
	2 36 38.8	63 10 20
	2 37 28.7	63 24 10

Index error — 13′ 20″. Barometer, 24.73 in. Thermometer, 38°.3.

CAMP No. 77—December 3, 1853.

α Lyræ	2 03 02.9	69 11 50
	2 03 44.1	68 57 00
	2 04 19.2	68 43 20
	2 04 57.2	68 30 00
	2 05 19 9	68 20 50
Saturn	2 06 41.4	59 33 20
	2 07 09.9	59 44 30
	2 07 36.5	59 56 30
	2 08 24.9	60 14 50
	2 08 55.0	60 28 40

CAMP No. 77—December 3, 1853—Continued.

Object observed.	Time of observat'n by chronometer.	Observed double altitude.
	h. *m.* *s.*	° ′ ″
Polaris	2 10 48.8	72 49 40
	2 11 32.3	72 49 50
	2 11 54.5	72 49 50
	2 12 38.5	72 50 00
	2 13 34.5	72 50 10
α Aurigæ	2 17 05.5	56 29 00
	2 17 27.5	56 37 10
	2 17 47.9	56 43 50
	2 18 08.6	56 50 30
	2 18 34.5	56 58 50
α Aquilæ	2 19 24.1	63 35 10
	2 19 53.2	63 13 00
	2 20 18.1	63 02 40
	2 20 46.7	62 52 30
	2 21 20.4	62 38 40

Index error — 13′. Barometer, 25.06 in. Thermometer, 38°.8.

CAMP No. 78, (*Colorado Chiquito*)—December 5, 1853.

Polaris	2 04 39.8	72 39 40
	2 05 38.7	72 39 40
	2 06 12.6	72 39 40
	2 06 40.5	72 39 50
	2 07 12.2	72 39 50
Saturn	2 08 55.0	60 19 00
	2 09 28.8	60 32 30
	2 09 53.4	60 42 10
	2 10 34.6	60 59 30
	2 11 04.5	61 11 30
Altair	2 12 50.8	66 27 50
	2 14 01.2	66 00 00
	2 14 40.9	65 43 20
	2 15 23.6	65 26 40
	2 16 09.9	65 08 10
α Lyræ	2 20 49.5	63 00 00
	2 21 16.5	62 51 50
	2 21 50.6	62 38 30
	2 22 32.4	62 23 40
	2 23 15.8	62 08 10
α Aurigæ	2 25 04.5	58 42 00
	2 26 02.5	59 00 20
	2 26 43.9	59 13 30
	2 27 22.3	59 26 00
	2 28 22.6	59 47 20

Index error — 13′. Barometer, 25.20 in. Thermometer, 25°.5.

APPENDIX A—Continued.

CAMP No. 79, (*Colorado Chiquito*)—DECEMBER 6, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	3	27	17.5	73	07	40
	3	29	29.9	73	08	00
	3	30	07.8	73	08	10
	3	30	43.5	73	08	10
	3	31	12.9	73	08	20
α Tauri	3	34	44.7	74	53	30
	3	35	49.2	75	22	00
	3	36	25.4	75	35	40
	3	37	00.6	75	50	10
	3	37	31.2	76	02	50
α Cygni	3	40	49.5	82	51	10
	3	41	22.8	82	39	30
	3	42	03.6	82	23	50

Index error — 13′. Barometer 25.43 in. Thermometer 30°.8.

CAMP No. 80, (*Colorado Chiquito*)—DECEMBER 7, 1853.

Saturn	2	17	26.1	63	20	40
	2	17	51.5	63	30	50
	2	18	21.4	63	42	40
	2	18	45.8	63	52	50
	2	19	39.2	64	15	30
α Lyræ	2	20	57.9	63	38	30
	2	21	36.1	63	24	40
	2	22	17.6	63	09	30
	2	22	53.6	62	57	00
	2	23	47.9	62	37	50
Polaris	2	26	30.1	72	57	50
	2	28	59.5	72	58	00
	2	29	17.5	72	58	00
	2	30	53.5	72	58	10
	2	32	09.2	72	58	10
Altair	2	34	39.1	58	21	10
	2	35	16.2	58	07	20
	2	35	53.6	57	52	20
	2	36	32.8	57	38	30
	2	37	17.1	57	18	40
α Aurigæ	2	39	04.4	62	49	00
	2	39	45.7	63	03	10
	2	40	26.5	63	16	20
	2	41	09.5	63	29	10
	2	42	02.6	63	47	20

Index error — 13′. Barometer 25.45 in. Thermometer 25°.5

CAMP No. 81, (*Colorado Chiquito*)—DECEMBER 8, 1853.

α Lyræ	2	14	31.9	66	10	10
	2	15	19.5	65	53	00
	2	16	01.0	65	36	40
	2	16	42.8	65	22	00
	2	17	49.1	64	58	10

CAMP No. 81, (*Colorado Chiquito*)—DEC. 8, 1853—Cont'd.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Saturn	2	18	54.5	63	51	50
	2	19	42.6	64	10	50
	2	20	04.3	64	20	30
	2	20	29.8	64	31	50
	2	21	01.4	64	43	50
Polaris	2	23	22.0	72	59	20

Index error — 13′. Barometer 25.28 in. Ther. 29°.5.

CAMP No. 82, (*Colorado Chiquito*)—DECEMBER 9, 1853.

Aldabaran	3	09	44.1	64	10	30
	3	10	28.4	64	28	40
	3	11	05.3	64	43	40
	3	11	56.9	65	04	20
	3	12	21.7	65	15	10
Polaris	3	45	17.5	73	16	40
	3	46	06.5	73	16	50
	3	46	52.5	73	16	50
	3	47	40.1	73	16	50
	3	48	08.6	73	17	00
α Cygni	3	51	57.5	79	31	10
	3	52	29.9	79	18	50
	3	53	01.6	79	07	30
	3	53	50.1	78	51	40
	3	54	47.1	78	32	40
α Aurigæ	3	56	37.4	88	47	20
	3	57	13.3	88	59	58
	3	57	43.5	89	10	20
	3	58	16.6	89	21	40
	3	58	48.8	89	33	00

Index error — 13′. Barometer 25.10 in. Ther. 40°.

CAMP No. 83, (*Colorado Chiquito*)—DECEMBER 14, 1853.

α Lyræ	2	21	35.4	63	58	40
	2	22	39.5	63	33	30
	2	25	19.6	62	37	00
	2	26	05.2	62	21	20
	2	26	44.5	62	05	50
Saturn	2	28	31.4	68	07	40
	2	29	03.1	68	17	40
	2	30	20.9	68	50	00
α Aurigæ	2	31	42.1	60	07	50
	2	32	10.2	60	17	20
	2	32	36.8	60	25	30
	2	33	13.2	60	36	50
	2	33	36.9	60	44	40
Altair	2	35	13.0	58	33	10
	2	35	43.5	58	23	50
	2	36	23.4	58	07	40
	2	37	03.9	57	09	40
	2	38	41.8	57	10	40
Polaris	2	48	12.5	73	14	00
	2	49	20.9	73	14	10
	2	49	51.5	73	14	10
	2	50	44.5	73	14	10

Index error — 13′. Barometer 25.06 in. Ther. 28°.

APPENDIX A—Continued.

CAMP No. 84, (*Colorado Chiquito*)—December 16, 1853.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Aldabaran	2	49	53.9	55	34	20
	2	50	41.8	55	54	00
	2	51	10.6	56	05	40
	2	51	33.7	56	15	20
	2	52	16.1	56	31	40
α Lyræ	2	53	58.1	52	40	50
	2	54	44.5	52	26	30
	2	55	18.6	52	15	10
	2	56	01.3	52	00	50
	2	56	35.0	51	48	10
Polaris	3	00	58.1	73	30	00
	3	01	51.8	73	30	00
	3	02	44.6	73	30	10

Index error — 13′. Barometer, 25.3 in. Thermometer, 12°.

CAMP No. 85, (*Colorado Chiquito*)—December 17, 1853.

α Lyræ	2	41	25.1	57	34	50
	2	42	05.6	57	20	40
	2	42	41.5	57	09	10
	2	43	16.9	56	55	40
	2	43	32.2	56	50	00
Aldabaran	2	46	38.6	53	50	00
	2	48	07.8	54	27	40
	2	49	22.2	54	57	30
	2	49	57.7	55	12	40
	2	50	38.8	55	29	50
Polaris	2	52	16.9	73	39	30
	2	53	11.1	73	39	40
	2	53	39.8	73	39	50
	2	54	43.6	73	39	50
	2	54	13.5	73	40	00

Index error — 13′. Barometer, 25.37 in. Thermometer, 20°.5.

CAMP No. 85, (*Colorado Chiquito*)—December 18, 1853.

Saturn	2	46	32.0	75	06	30
	2	47	33.9	75	31	40
	2	48	09.6	75	46	30
	2	48	51.2	76	04	00
	2	49	21.1	76	15	20
α Lyræ	2	50	32.5	54	25	40
	2	51	12.6	54	11	50
	2	52	03.5	53	53	50
	2	52	39.6	53	40	30
	2	53	22.8	53	25	50
α Aurigæ	2	55	58.0	67	47	30
	2	56	35.9	67	59	30
	2	57	19.9	68	14	20
	2	58	08.6	68	30	10
	2	59	13.2	68	51	00

CAMP No. 85, (*Colorado Chiquito*)—December 18, 1853—Cont.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Aldabaran	3	02	12.5	60	07	00
	3	03	01.6	60	28	10
	3	03	56.9	60	50	00
	3	04	46.1	61	10	50
	3	05	11.5	61	20	40
Altair	3	07	02.9	46	23	40
	3	07	37.9	46	10	00
	3	08	06.8	45	58	10
	3	08	36.7	45	45	30
	3	09	02.5	45	35	20
α Cygni	3	12	11.9	94	27	50
	3	12	47.1	94	16	00
	3	13	16.7	94	05	50
	3	13	53.6	93	52	30
	3	14	21.4	93	43	10
Polaris	3	15	59.5	73	45	10
	3	16	46.5	73	45	10

Index error — 13′. Barometer, 25.38 in. Thermometer, 12°.

CAMP No. 87, (*Colorado Chiquito*)—December 20, 1853.

α Lyræ	2	51	15.5	54	15	10
	2	52	01.9	54	00	10
	2	52	23.9	53	52	40
	2	53	06.8	53	37	50
	2	53	35.4	53	26	50
Aldabaran	2	56	35.4	57	45	10
	2	57	35.4	58	09	40
	2	58	11.2	58	24	20
	2	59	41.5	59	00	00
	2	00	02.5	59	10	00
Polaris	3	08	34.6	73	44	20
	3	12	40.6	73	44	50

Index error — 13′. Barometer, 25.31 in. Thermometer, 33°.5.

SEXTANT No. 3.

CAMP No. 89—December 23, 1853.

α Andromeda	5	25	23.0	115	15	40
	5	26	38.5	114	45	10
	5	27	46.4	114	17	40
	5	28	33.5	113	58	00
Pegasi	5	32	12.7	73	24	50
Aldabaran	5	34	01.7	118	27	00
	5	34	50.1	118	44	20
	5	36	09.8	119	12	00
	5	36	53.6	119	26	30
	5	37	46.1	119	44	20

APPENDIX A—Continued.

CAMP No. 89—December 23, 1853—Continued.

Object observed.	Time of observ'n by chronometer.	Observed double altitude.
	h. m. s.	° ′ ″
α Orionis	5 40 14.0	100 36 50
Polaris	5 46 02.0	73 07 10
	5 48 14.4	73 06 40
	5 49 29.9	73 06 30

Index error + 1′ 50″. Barometer 23.92 in. Ther. 6°.

CAMP No. 89—December 24, 1853.

α Tauri	3 27 41.9	69 15 50
	3 29 14.8	69 54 00
	3 30 00.1	70 11 50
	3 31 03.5	70 38 30
	3 31 50.9	70 57 30
	3 32 42.5	71 18 10
α Cygni	3 35 20.6	86 54 00
	3 36 10.4	86 36 30
	3 36 52.5	86 22 50
	3 37 47.1	86 02 50
	3 38 22.9	85 50 30
	3 39 00.4	85 37 20
Polaris	3 41 31.7	73 26 00
	3 43 16.0	73 26 30
	3 44 04.8	73 27 00
	3 46 03.2	73 26 00
	3 46 42.3	73 26 00

Index error + 1′ 50″. Barometer 23.87 in. Ther. 15°.3.

CAMP No. 91, (*Leroux's spring*)—December 27, 1853.

Aldabaran	4 33 39.9	95 05 10
	4 34 23.8	95 23 00
	4 35 09.6	95 41 00
	4 35 51.0	95 57 10
	4 36 32.0	96 13 00
Pegasi	4 41 59.2	94 03 10
	4 43 08.0	93 37 20
	4 44 11.1	93 12 00
	4 45 14.8	92 47 30
	4 46 17.7	92 21 50
Polaris	4 50 51.0	73 25 00
	4 51 56.2	73 25 40
	4 52 54.3	73 26 00
	4 53 59.3	73 25 20

Index error —1′ 50″. Barometer 23.02 in. Ther. 29°.5.

CAMP No. 91, (*Leroux's spring*)—December 28, 1853.

Aldabaran	3 23 28.3	70 54 30
	3 38 28.4	72 55 00
	3 39 25.3	73 19 10
	3 40 14.6	73 39 40
	3 40 59.5	73 57 00
	3 41 49.0	74 16 50

CAMP No. 91—December 28, 1853—Continued.

Object observed.	Time of observ'n by chronometer.	Observed double altitude.
	h. m. s.	° ′ ″
Polaris	3 43 17.1	73 30 00
	3 46 28.0	73 30 20
	3 47 51.2	73 30 50
	3 51 37.3	73 30 50
	3 54 31.0	73 30 40

Index error + 1′ 50″. Barometer 22.9 in. Ther. 44°.9.

CAMP No. 91, (*Leroux's spring*)—December 29, 1853.

α Cygni	3 35 15.1	87 38 00
	3 35 52.3	87 25 00
	3 36 38.0	87 09 20
	3 37 17.2	86 56 00
Aldabaran	3 42 44.8	74 36 40
	3 44 42.6	75 24 20
	3 45 36.0	75 45 50
	3 47 12.9	76 25 00
	3 48 38.9	77 00 00
Polaris	3 51 33.0	73 29 40
	3 52 34.0	73 30 10
	3 54 02.9	73 30 00
	3 55 40.7	73 30 10
	3 56 33.2	73 29 50

Index error + 1′ 50″. Barometer 22.82 in. Ther. 28°.

SEXTANT No. 2.

CAMP No. 91—December 30, 1853.

Aldabaran	3 37 07.0	84 05 00
	3 39 39.5	84 56 10

Index error —13′. Barometer 22.18 in. Ther. 28°.

SEXTANT No. 3.

CAMP No. 92—December 31, 1853.

Aldabaran	4 10 27.5	87 17 10
	4 12 28.0	88 02 00
	4 13 54.0	88 34 00
	4 14 51.0	88 56 00
	4 16 36.5	89 41 00
α Cygni	4 55 39.5	67 31 50
	4 57 09.7	67 12 10
	4 57 49.5	67 00 00
	4 58 52.0	66 48 40
	4 59 35.5	66 36 00

Index error + 1′ 50″. Barometer 23.02 in. Ther. 30°.

APPENDIX A—Continued.

SEXTANT No. 2.

CAMP No. 93—JANUARY 1, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Aurigæ	4	19	03.5	108	24	40
	4	20	20.5	108	51	00
	4	21	05.9	109	05	30
	4	21	51.6	109	20	00
	4	22	36.1	109	38	00
	4	23	36.5	110	02	00
	4	24	53.5	110	27	50
Pegasi	4	33	07.0	107	07	00
	4	33	57.6	106	52	00
	4	34	46.4	106	28	40
	4	36	14.5	105	51	00
	4	37	11.9	105	27	30
	4	38	05.4	105	11	00
	4	39	13.5	104	51	30
Polaris	4	59	49.5	73	22	00
	5	01	14.6	73	30	00
	5	02	04.5	73	31	00
	5	03	20.7	73	33	00
	5	04	46.9	73	40	00
	5	06	07.0	73	40	00

Index error — 13′ 30″. Barometer, 23.02 in. Thermometer, 30°.

CAMP No. 94—JANUARY 2, 1854.

Saturn	3	49	49.9	99	06	20
	3	51	10.0	99	40	00
	3	51	58.3	99	59	20
	3	53	42.2	100	38	20
	3	55	26.7	101	22	00
	3	57	00.1	101	56	30
α Aurigæ	4	00	00.1	87	20	00
	4	02	31.4	88	11	30
α Cygni	4	10	34.0	76	21	30
	4	12	26.1	75	45	30
	4	14	56.0	74	51	00
	4	17	15.1	74	04	20
	4	18	26.0	73	41	30
Polaris	4	33	42.4	73	51	00
	4	34	15.0	73	51	00
	4	36	47.5	73	51	20
	4	37	42.0	73	51	00
	4	38	42.0	73	51	00
	4	40	46.9	73	49	30
	4	41	56.0	73	49	30
	4	42	51.2	73	49	30
	4	47	18.1	73	47	30
	4	52	08.0	73	47	40
	4	53	46.9	73	46	30
	4	55	36.0	73	45	40
	4	57	17.6	73	45	40

Index error — 13′. Barometer, 23.02 in. Thermometer, 30°.

CAMP No. 94—JANUARY 3, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Aurigæ	3	54	18.5	88	27	30
	3	55	33.0	88	56	00
	3	56	26.5	89	20	00
	3	57	06.0	89	28	10
	3	58	00.0	89	52	40
α Cygni	4	07	12.5	78	14	00
	4	08	10.5	78	01	30
	4	09	04.0	77	42	00
	4	10	02.2	77	22	40
	4	11	04.5	77	04	20
Polaris	4	13	30.0	73	50	30
	4	14	30.0	73	51	00
	4	15	26.5	73	53	00
	4	17	05.0	73	53	00
	4	17	56.0	73	51	00
	4	18	53.0	73	51	00
	4	19	17.0	73	50	00

Index error — 13′. Barometer, 23.50 in. Thermometer, 30°.5.

CAMP No. 94—JANUARY 4, 1854.

α Aurigæ	4	02	57.0	91	32	10
	4	04	05.5	91	59	30
	4	05	23.5	92	25	40
	4	07	28.7	93	10	40
Aldabaran	4	09	26.5	86	11	20
	4	10	20.5	86	32	20
	4	10	57.7	86	47	50
α Cygni	4	12	50.5	76	26	20
	4	13	36.2	76	10	10
	4	14	22.0	75	56	40
	4	15	05.0	75	37	00
	4	15	47.5	75	25	10
Polaris	4	18	23.0	73	52	20
	4	19	27.0	73	53	40
	4	20	06.2	73	54	10
	4	21	46.0	73	51	30
	4	22	21.0	73	51	30
	4	22	54.2	73	51	30
	4	23	46.2	73	50	50

Index error — 13′ 30″. Barometer, 23.31 in. Thermometer, 29°.5.

CAMP No. 94—JANUARY 6, 1854.

α Cygni	4	06	24.4	77	49	50
	4	07	03.1	77	37	20
	4	07	43.0	77	24	40
	4	08	40.1	77	05	30

APPENDIX A—Continued.

CAMP No. 94—JANUARY 6, 1854—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude		
	h.	*m.*	*s.*	°	′	″
Aldabaran	4	13	13.0	86	16	20
	4	13	54.0	86	32	10
	4	14	29.0	86	48	20
	4	15	09.0	87	02	30
α Aurigæ	4	16	21.2	92	53	50
	4	16	54.1	93	03	50
	4	17	28.3	93	16	30
	4	18	04.1	93	27	00
Polaris	4	22	13.0	73	47	50
	4	22	19.1	73	47	50
	4	23	21.2	73	48	00

Index error — 13′. Barometer, 23.58 in. Thermometer, 23°.2.

CAMP No. 96—JANUARY 9, 1854.

α Aurigæ	5	36	11.2	120	09	20
	5	37	27.3	120	34	30
	5	38	57.1	121	06	20
	5	39	28.1	121	17	10
	5	40	04.1	121	29	10
Polaris	6	07	39.8	73	14	50
	6	08	45.9	73	14	30
	6	09	55.0	73	14	00
α Andromedæ	6	15	00.2	111	56	50
	6	19	44.0	110	43	40
	6	21	03.2	109	33	20
	6	22	14.4	109	02	50
α Orionis	6	29	00.0	95	30	20
	6	29	30.0	95	41	40

Index error — 13′. Barometer, 24.36 in. Thermometer, 28°.6.

CAMP No. 97—JANUARY 10, 1854.

Polaris	8	15	41.3	72	12	50
	8	16	26.0	72	11	20
	8	17	29.2	72	11	00
	8	18	08.8	72	10	00
	8	22	28.0	72	08	30
	8	23	26.1	72	08	20
	8	24	04.0	72	07	30
	8	24	56.8	72	06	00
	8	25	43.0	72	05	10

Index error — 13′. Barometer, 24.98 in. Thermometer, 26°.5.

CAMP No. 97—JANUARY 12, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	5	30	21.1	73	30	00
	5	31	01.2	73	29	50
	5	32	11.0	73	29	40
	5	33	08.9	73	29	40
	5	33	39.0	73	29	40
	5	34	09.0	73	29	30
	5	34	51.3	73	29	30
	5	35	25.1	73	29	20
α Cygni	5	38	28.2	48	10	00
	5	39	08.0	47	57	10
	5	40	56.6	47	22	40
	5	41	31.7	47	13	00
	5	41	58.0	47	03	40

Index error — 13′. Barometer, 24.87 in. Thermometer, 27°.

CAMP No. 98—JANUARY 12, 1854.

α Orion	5	49	49.8	81	07	30
	5	50	49.0	81	27	50
	5	51	36.6	81	47	20
	5	52	22.8	82	06	30

Index error — 13′. Barometer, 24.87 in. Thermometer 27°.

CAMP No. 99—JANUARY 15, 1854.

Polaris	5	42	04.6	73	14	50
	5	42	37.2	73	14	50
	5	43	08.0	73	14	30
	5	43	43.9	73	14	10
	5	44	36.2	73	14	10
	5	45	41.2	73	14	00
α Cygni	5	17	07.0	55	02	10
	5	18	01.9	54	50	20
	5	18	59.0	54	30	00
	5	19	43.0	54	16	50
	5	20	20.2	54	04	00
	5	20	50.1	53	55	20
Orion	5	37	49.1	76	14	30
	5	38	21.4	76	26	20
	5	38	59.0	76	42	30
	5	39	26.2	76	50	40
	5	39	51.8	77	00	00
	5	40	18.0	77	10	20

Index error — 13′. Barometer, 25.04 in. Thermometer, 25°.

APPENDIX A—Continued.

CAMP No. 100—JANUARY 17, 1854.

Object observed.	Time of observat'n by chronometer.	Observed double altitude.
	h. *m.* *s.*	° ′ ″
a Cygni	5 01 26.1	60 31 00
	5 02 02.5	60 16 40
	5 02 48.4	60 02 40
	5 03 23.0	59 52 30
	5 04 10.0	59 36 30
	5 04 45.1	59 25 40
	5 05 23.7	59 13 20
	5 05 54.0	59 01 50
a Orion	5 08 35.8	64 46 00
	5 09 27.7	65 07 40
	5 10 12.0	65 23 20
	5 10 40.0	65 34 10
	5 11 18.0	65 49 20
	5 11 55.2	66 03 40
	5 12 24.6	66 14 10
Polaris	5 15 48.1	73 21 00
	5 16 29.0	73 21 00
	5 16 56.9	73 20 50
	5 17 33.1	73 20 50
	5 18 24.0	73 20 40
	5 18 51.0	73 20 40
	5 19 15.0	73 20 30
	5 19 42.6	73 20 30

Index error — 13′. Barometer, 25.28 in. Thermometer, 21°.5.

CAMP No. 102—JANUARY 20, 1854.

a Cygni	5 15 16.6	56 01 10
	5 15 55.1	55 47 20
	5 16 23.4	55 38 40
	5 16 58.0	55 26 40
	5 17 29.5	55 17 10
a Orionis	5 19 25.6	68 46 10
	5 20 08.1	69 02 50
	5 20 34.0	69 14 10
	5 21 08.0	69 28 50
	5 21 35.4	69 39 10
Polaris	5 23 43.8	73 00 10
	5 24 16.0	73 00 00
	5 25 16.7	73 00 00
	5 25 36.0	72 59 50
	5 26 03.5	72 59 50

Index error — 13′. Barometer, 24.46 in. Thermometer, 5°.

CAMP No. 103—JANUARY 21, 1854.

a Cygni	5 19 22.6	54 40 00
	5 19 55.0	54 31 20
	5 20 32.6	54 19 00
	5 20 59.9	54 09 30
	5 21 43.4	53 56 10

CAMP No. 103—JANUARY 21, 1854—Continued.

Object observed.	Time of observat'n by chronometer.	Observed double altitude.
	h. *m.* *s.*	° ′ ″
a Orionis	5 25 17.1	71 00 00
	5 26 21.9	71 27 40
	5 27 14.9	71 48 10
	5 28 40.6	72 20 00
	5 29 35.9	72 42 50
	5 30 26.0	73 02 00
Polaris	5 33 35.4	72 52 00
	5 35 22.4	72 51 50
	5 36 29.5	72 51 40
	5 37 14.9	72 51 30
	5 37 42.1	72 51 20

Index error — 13′. Barometer, 24.99 in. Thermometer, 21°.5.

CAMP No. 104—JANUARY 22, 1854.

a Cygni	5 17 10.0	55 28 10
	5 17 54.5	55 19 10
	5 18 24.9	55 10 20
	5 19 02.1	54 59 00
	5 19 28.5	54 41 50
	5 19 57.5	54 40 50
a Orionis	5 24 15.5	70 24 30
	5 25 28.9	70 54 30
	5 26 08.5	71 08 40
	5 26 53.6	71 27 20
	5 27 21.2	71 38 50
	5 27 48.9	71 49 50
Polaris	5 30 49.9	72 51 10
	5 31 50.8	72 51 10
	5 32 25.4	72 51 00
	5 32 50.3	72 51 00
	5 33 41.5	72 51 00
	5 34 09.6	72 50 50

Index error — 13′. Barometer, 24.53 in. Thermometer, 26°.

CAMP No. 105—JANUARY 23, 1854.

Polaris	7 20 45.9	72 10 50
	7 21 40.6	72 10 50
	7 23 09.0	72 10 40
	7 23 48.5	72 10 30
	7 24 31.8	72 10 10
a Orionis	7 13 52.5	108 49 50
	7 14 22.6	108 56 30
	7 14 54.6	109 06 20
	7 15 28.4	109 16 10
	7 16 08.8	109 30 00
	7 16 29.4	109 35 20

Index error — 13′. Barometer, 24.4 in. Thermometer, 38°.

APPENDIX A—Continued.

CAMP No. 106—JANUARY 24, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Polaris	5	35	42.5	73	03	20
	5	36	11.0	73	03	20
	5	38	38.6	73	03	00
	5	39	27.2	73	02	40
	5	39	52.8	73	02	30
	5	40	30.6	73	02	20
	5	40	53.3	73	02	20
α Cygni	5	42	09.9	47	59	00
	5	42	51.6	47	43	00
	5	43	29.5	47	33	30
	5	43	58.6	47	23	20
	5	45	25.0	46	55	30
α Orionis	5	48	37.5	79	20	10
	5	49	03.9	79	33	30
	5	49	36.1	79	46	10
	5	50	03.8	79	55	40
	5	50	31.6	80	03	30
β Orionis	5	52	40.4	70	59	10
	5	53	09.6	71	08	20
	5	53	31.4	71	16	20
	5	53	57.6	71	20	40
	5	53	41.6	71	34	40
α Andromedæ	6	02	23.0	104	47	50
	6	03	31.1	104	23	40
	6	04	04.6	104	06	10
	6	04	43.5	103	52	50
	6	05	13.6	103	40	30

Index error — 13′. Barometer, 24.74 in. Thermometer, 39°.5.

CAMP No. 107—JANUARY 27, 1854.

α Orionis	6	40	50.2	97	48	50
	6	41	26.6	98	00	30
	6	41	53.0	98	10	50
	6	42	09.9	98	15	30
	6	42	41.6	98	25	30
	6	43	11.8	98	34	50
	6	43	34.9	98	46	10
α Andromedæ	6	59	25.6	96	20	10
	7	00	08.9	96	03	50
	7	00	47.1	95	49	00
	7	01	15.5	95	37	20
	7	01	39.6	95	27	40
	7	02	11.3	95	15	00
	7	02	51.9	94	57	50
Polaris	7	05	36.5	72	35	30
	7	06	07.5	72	34	00
	7	06	42.5	72	34	00
	7	07	06.2	72	33	20
	7	07	36.1	72	33	20

Index error — 13′. Barometer, 25.37 in. Thermometer, 30°.5.

CAMP No. 108—JANUARY 28, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Orionis	5	57	28.9	82	18	10
	5	58	12.7	82	34	40
	5	58	34.3	82	46	50
	5	59	13.3	82	58	30
	5	59	38.5	83	08	10
	5	00	11.7	83	20	20
Polaris	6	02	51.6	73	03	40
	6	03	36.7	73	03	30
	6	04	10.2	73	03	30
	6	04	40.6	73	00	00
	6	05	04.0	73	03	00
	6	05	22.0	73	02	50
	6	05	44.5	73	02	50
	6	06	03.5	73	02	50
	6	06	27.9	73	02	40
α Andromedæ	6	10	04.8	102	07	20
	6	10	48.5	101	49	00
	6	11	36.9	101	30	10
	6	12	15.4	101	15	00
	6	12	41.0	101	01	50
	6	13	13.6	100	51	20
	6	13	48.4	100	36	00

Index error — 13′. Barometer, 25.31 in. Thermometer, 40°.

CAMP No. 109—JANUARY 30, 1854.

Polaris	7	40	14.7	72	27	30
	7	40	44.9	72	27	30
	7	41	07.0	72	27	20
	7	41	29.6	72	27	20
	7	41	45.7	72	27	10
Procyon	7	43	58.5	80	21	40
	7	44	21.6	80	30	50
	7	44	47.1	80	40	00
	7	45	05.8	80	46	30
	7	45	31.9	80	55	10
	7	45	56.5	81	05	00
Sirius	7	47	54.5	62	37	10
	7	48	25.9	62	44	20
	7	48	57.5	62	51	20
	7	49	17.9	62	56	50
	7	49	45.0	63	02	40
	7	50	09.5	63	08	10
α Arietis	7	56	56.0	102	11	40
	7	57	46.7	101	53	50
	7	58	28.1	101	40	30
	7	59	02.4	101	26	30
	7	59	30.2	101	15	10
	8	00	06.6	101	00	00

Index error — 13′. Barometer, 25.13 in. Thermometer, 42°.

APPENDIX A—Continued.

CAMP No. 110—JANUARY 31, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Andromedæ	7	30	23.6	70	12	10
	7	30	53.6	70	09	20
	7	31	25.8	69	46	00
	7	31	59.5	69	33	30
	7	32	33.6	69	21	10
	7	33	04.5	69	07	40
	7	33	41.5	68	54	30
Polaris	7	35	26.6	72	32	30
	7	36	40.5	72	32	20
	7	37	23.0	72	32	10
	7	38	02.3	72	32	10
	7	38	30.8	72	32	00
	7	38	51.5	72	32	00
	7	39	10.1	72	31	50
Procyon	7	40	44.5	78	53	20
	7	41	13.8	79	04	10
	7	41	41.9	79	14	30
	7	42	05.6	79	23	20
	7	42	29.6	79	32	30
	7	43	08.5	79	47	10
Sirius	7	44	58.9	61	46	20
	7	45	29.9	61	53	10
	7	45	58.4	61	59	30
	7	46	23.8	62	05	40
	7	46	54.7	62	12	40
	7	47	19.1	62	17	40
	7	47	46.5	62	23	20
α Arietis	7	51	29.6	100	59	30
	7	51	58.8	100	45	10
	7	52	28.8	100	33	40
	7	52	49.1	100	25	20
	7	53	17.8	100	13	10
	7	53	40.4	100	04	20
	7	54	03.4	99	55	00

Index error — 13′. Barometer, 24.92 in. Thermometer, 49°.5.

CAMP No. 111—FEBRUARY 1, 1854.

Procyon	8	23	33.5	94	00	10
	8	24	05.2	94	10	20
	8	24	26.4	94	16	40
	8	24	50.5	94	25	40
	8	25	25.5	94	38	10
	8	25	49.4	94	45	40
	8	26	21.5	94	56	40
Polaris	8	29	20.3	71	48	10
	8	30	22.6	71	47	30
	8	31	04.2	71	47	00
	8	31	31.5	71	47	00
	8	31	59.5	71	46	10
	8	32	59.6	71	46	00
	8	33	22.1	71	45	20
	8	33	50.8	71	45	00

CAMP No. 111—FEBRUARY 1, 1854—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Arietis	8	37	53.8	85	55	20
	8	38	57.5	85	34	00
	8	39	34.7	85	12	30
	8	41	10.8	84	40	20
	8	41	48.4	84	17	30
	8	42	31.6	84	06	20
Sirius	8	46	07.9	72	59	40
	8	47	45.5	73	10	30
	8	48	15.4	73	15	30
	8	49	27.6	73	20	00
	8	49	48.5	73	26	30
	8	50	40.8	73	33	00
Saturn	8	53	01.7	111	12	50
	8	53	37.8	110	59	30
	8	54	31.8	110	39	20
	8	54	57.5	110	29	00
	8	55	25.3	110	18	10
	8	55	54.5	110	07	20

Index error — 13′. Barometer, 26.34 in. Thermometer, 43°.

CAMP No. 111—FEBRUARY 2, 1854.

Procyon	8	09	46.1	89	15	00
	8	10	37.8	89	34	10
	8	11	10.0	89	44	50
	8	11	40.8	89	55	30
	8	12	04.6	90	02	20
	8	12	32.1	90	13	10
β Orionis	8	14	29.6	93	13	30
	8	15	08.6	93	15	00
	8	15	48.5	93	15	00
	8	16	21.5	93	14	20
	8	16	53.7	93	14	20
Polaris	8	20	51.2	71	54	20
	8	21	55.5	71	53	50
	8	21	25.6	71	53	30
	8	22	48.8	71	53	20
	8	23	15.7	71	53	00
	8	23	34.8	71	52	40
	8	23	55.7	71	52	10
α Arietis	8	27	33.3	90	15	40
	8	28	12.5	90	00	00
	8	28	30.8	89	45	10
	8	29	38.4	89	23	40
	8	30	07.5	89	13	00

Index error —13′. Barometer, 26.4 in. Thermometer, 47°.

APPENDIX A—Continued.

CAMP No. 112—February 4, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Polaris	8	07	33.5	71	49	50
	8	08	16.8	71	49	30
	8	08	40.7	71	49	00
	8	09	05.6	71	48	40
	8	09	26.5	71	48	00
	8	09	49.4	71	47	30
	8	10	06.5	71	47	10
β Orionis	8	13	13.3	93	28	20
	8	14	07.1	93	29	10
	8	14	54.0	93	29	30
	8	16	47.5	93	29	30
	8	19	00.9	93	29	00
	8	19	37.0	93	28	40
	8	20	03.9	93	28	30
Procyon	8	22	22.8	93	29	30
	8	23	07.9	93	45	30
	8	23	37.7	93	54	30
	8	24	08.9	94	05	00
	8	24	56.5	94	20	30
	8	25	19.9	94	29	20
α Arietis	8	28	40.8	90	05	10
	8	29	52.1	89	35	00
	8	30	28.6	89	20	00
	8	30	51.5	89	10	20
	8	31	12.8	89	01	30
	8	31	48.5	88	47	00

Index error — 13′. Barometer, 27.14 in. Thermometer, 40°.5.

CAMP No. 113—February 6, 1854.

Sirius	9	30	14.5	77	27	10
	9	31	42.9	77	28	50
	9	32	29.9	77	31	20
	9	33	13.8	77	32	40
	9	34	06.1	77	34	00
	9	35	25.0	77	36	30
	9	36	04.5	77	40	00
	9	37	56.0	77	40	00
	9	38	13.6	77	41	20
	9	39	27.5	77	42	50
	9	40	41.6	77	43	30
	9	41	38.5	77	45	20
	9	42	43.0	77	46	00
	9	44	22.4	77	47	20
	9	45	29.5	77	47	30
	9	46	05.5	77	47	30
	9	46	47.0	77	47	50
	9	47	47.9	77	47	50
	9	49	46.5	77	47	20
	9	51	12.5	77	47	20
	9	52	41.4	77	46	00
	9	55	27.9	77	43	00
	9	56	09.1	77	42	30

CAMP No. 113—February 6, 1854—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Leonis	9	57	58.9	83	07	20
	9	58	42.6	83	25	30
	9	59	10.6	83	36	10
	9	59	37.2	83	46	00
	10	00	04.5	83	58	30
Polaris	10	02	07.9	69	50	00
	10	04	15.7	69	48	00
	10	05	28.9	69	47	00
	10	06	09.8	69	46	40
	10	06	37.6	69	46	30
	10	07	11.5	69	46	10
Saturn	10	09	47.9	81	36	00
	10	10	39.5	81	14	10
	10	11	14.6	81	00	00
	10	11	34.6	80	52	10
	10	12	00.5	80	41	00

Index error — 13′. Barometer 27.82 in. Thermometer 52°.2.

CAMP No. 116—February 8, 1854.

Sirius	9	38	35.5	77	56	00
	9	40	42.5	77	59	00
	9	48	34.0	78	01	30
	9	54	31.1	77	59	00
	9	55	27.2	77	57	00
	9	56	14.5	77	56	00

Index error — 13′. Barometer, 27.82 in. Thermometer, 52°.2.

CAMP No. 117—February 9, 1854.

Sirius	9	46	10.0	78	08	10
	9	46	42.6	78	08	50
	9	47	14.6	78	09	00
	9	47	38.5	78	09	10
	9	48	19.5	78	09	10
	9	48	59.5	78	08	50
	9	49	45.4	78	08	30
	9	50	40.2	78	08	10
Polaris	10	06	33.0	69	27	00
	10	08	13.5	69	25	00
	10	08	58.5	69	25	00
	10	09	46.4	69	24	30
	10	10	14.5	69	23	40

Index error — 13′. Barometer, 28.43 in. Thermometer 44°.

APPENDIX A—Continued.

CAMP No. 121—February 13, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Polaris	8	57	51.2	69	46	50
	8	58	32.6	69	46	20
	8	58	53.5	69	45	50
	8	59	19.5	69	45	30
	8	59	38.4	69	45	20
	9	00	00.6	69	45	00

Index error — 13′. Barometer, 28.97 in. Thermometer 59°.5.

CAMP No. 122—February 15, 1854.

Polaris	9	53	34.5	68	57	40
	9	54	16.6	68	56	50
	9	54	46.0	68	56	10
	9	55	12.5	68	55	40
	9	55	33.9	68	55	00

Index error — 13′. Barometer, 29.16 in. Thermometer, 41°.7.

CAMP No. 125—February 18, 1854.

Procyon	8	08	43.9	88	12	20
	8	09	15.1	88	24	00
	8	09	42.6	88	33	50
	8	10	07.0	88	42	40
	8	10	28.9	88	50	40
β Orionis	8	13	16.5	94	56	20
	8	13	55.5	94	56	30
	8	14	26.6	94	56	40
	8	14	55.5	94	56	50
	8	16	13.8	94	59	10
	8	17	00.6	94	59	10
	8	19	26.5	94	59	00
	8	21	46.0	94	58	40
	8	24	09.6	94	58	00
Polaris	8	28	56.9	70	05	00
	8	29	25.0	70	04	50
	8	29	48.0	70	04	40
	8	30	06.5	70	04	30
	8	30	24.6	70	04	20
α Arietis	8	32	24.5	90	11	20
	8	33	15.5	89	47	50
	8	34	22.8	89	20	00
	8	34	40.3	89	11	00
	8	35	01.2	89	03	20

Index error — 13′. Barometer 29.63 in. Thermometer 42°.5.

CAMP No. 126—February 19, 1854.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Procyon	8	03	33.5	86	04	30
	8	04	41.7	86	29	50
	8	05	10.6	86	40	10
	8	05	36.6	86	49	00
	8	06	00.4	86	58	20
Polaris	8	08	20.2	70	23	50
	8	09	16.1	70	23	40
	8	09	42.9	70	23	40
β Orionis	8	11	38.9	94	49	20
	8	12	17.7	94	50	00
	8	13	31.6	94	50	30
	8	14	05.5	94	50	50
	8	14	33.1	94	51	30
	8	15	07.2	94	52	00
	8	15	35.9	94	52	40
	8	16	01.6	94	52	50
	8	17	04.5	94	54	00
	8	17	36.9	94	54	50
	8	18	08.4	94	55	30
	8	18	42.9	94	55	30
	8	19	30.0	94	55	50
	8	20	02.1	94	55	50
	8	21	08.0	94	55	20
	8	22	56.5	94	54	40
	8	25	13.9	94	53	30
α Arietis	8	28	54.5	91	44	50
	8	29	38.6	91	33	10
	8	30	00.3	91	25	10
	8	30	35.8	91	09	30
	8	31	13.8	90	55	10

Index error — 13′. Barometer 29.66 in. Thermometer 45°.5

CAMP No. 127, (*Rio Colorado*)—February 20, 1854.

Procyon	8	23	36.5	92	54	20
	8	24	04.6	93	04	20
	8	24	32.7	93	14	30
	8	24	58.8	93	22	40
	8	25	19.6	93	30	40
	8	25	39.4	93	37	40
α Arietis	8	27	36.9	92	32	40
	8	28	08.1	92	29	00
	8	28	40.5	92	12	40
	8	29	25.9	91	54	30
	8	29	47.6	91	45	10
	8	30	08.5	91	36	20
Polaris	8	32	21.9	70	17	00
	8	32	50.8	70	16	50
	8	33	09.3	70	16	50
	8	33	33.9	70	16	40
	8	34	08.1	70	16	10
	8	34	33.0	70	16	00
	8	34	52.6	70	15	40

Index error — 13′. Barometer 29.78 in. Thermometer 49°.5.

APPENDIX A—Continued.

CAMP No. 128, (*Rio Colorado*)—FEBRUARY 21, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Polaris	10	00	38.5	69	15	30
	10	01	13.6	69	15	10
	10	01	37.1	69	15	00
	10	01	58.0	69	14	40
	10	02	28.4	69	14	10
	10	02	46.5	69	14	00
Saturn	10	06	24.5	86	18	30
	10	07	09.9	86	04	00
	10	07	41.5	85	50	20
	10	08	07.9	85	40	40
	10	08	52.5	85	21	50
	10	09	17.1	85	12	00
	10	09	41.0	85	03	20
Mars	10	14	23.6	66	00	10
	10	14	56.0	66	15	00
	10	15	15.9	66	23	20
	10	15	53.9	66	38	40
	10	16	16.5	66	48	00
Leonis	10	11	15.9	86	24	30
	10	11	48 5	86	38	00
	10	12	17.4	86	48	50
	10	12	43.8	87	00	00
	10	13	16.5	87	12	10

Index error — 13′. Barometer 29.78 in. Thermometer 49°.5.

SEXTANT No. 3.

CAMP No. 130, (*Rio Colorado*)—FEBRUARY 23, 1854.

β Orionis	8	21	59.0	93	02	20
	8	25	48.8	93	01	30
Polaris	8	27	38.4	70	35	30
	8	32	20.9	70	33	00
	8	34	07.1	70	32	00
	8	34	38.8	70	30	50
Procyon	8	38	12.1	96	46	00
	8	39	08.5	97	04	10
	8	41	29.1	97	50	10
	8	42	51.8	98	16	40
	8	44	10.0	98	41	50
α Arietis	8	46	33.5	85	15	50
	8	47	48.5	84	45	10
	8	48	51.6	84	20	00
	8	49	37.1	84	00	00
	8	50	07.9	83	48	40

Index error + 1′ 50″. Barometer 29.55 in. Thermometer 58°.5.

CAMP No. 131, (*Rio Colorado*)—FEBRUARY 24, 1854.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	*m*	*s.*	°	′	″
α Leonis	9	44	58.5	74	50	10
	9	46	13.1	75	19	50
	9	47	03.6	75	41	10
	9	47	46.6	75	57	20
	9	48	31.5	76	15	20
Saturn	9	50	01.9	93	35	40
	9	51	01.8	93	12	00
	9	52	42.4	92	54	50
	9	52	29.4	92	36	00
	9	53	07.0	92	21	10
Polaris	9	55	37.5	69	48	20
	9	56	36.8	69	47	40
	9	57	09.5	69	47	20
	9	58	03.0	69	46	50
	9	58	40.9	69	46	30

Index error + 1′ 50″. Barometer 29.74 in. Thermometer 51°.3.

CAMP No. 132—FEBRUARY 25, 1854.

Procyon	8	39	43.5	96	51	10
	8	40	51.9	97	13	50
	8	41	36.0	97	27	20
	8	42	34.8	97	46	50
	8	43	09.5	97	58	20
α Arietis	8	46	20.5	85	38	10
	8	47	06.4	85	20	00
	8	47	29.9	85	10	20
	8	47	59.2	84	58	30
	8	48	33.6	84	43	50
Polaris	8	50	10.5	70	39	50
	8	51	00.6	70	39	20
	8	51	44.3	70	39	00
	8	52	20.5	70	38	10
	8	52	51.5	70	38	00

Index error + 1′ 50″. Barometer, 29.63 in. Thermometer, 54°.3.

CAMP No. 133—FEBRUARY 26, 1854.

α Leonis	10	38	04.5	95	21	20
	10	38	47.8	95	37	20
	10	39	30.2	95	52	30
	10	39	57.6	96	03	10
	10	40	23.3	96	13	10
Mars	10	42	54.8	79	56	30
	10	43	39.5	80	14	20
	10	44	10.8	80	27	20
	10	44	46.8	80	41	10
	10	45	08.5	80	50	00
	10	45	27.6	80	57	30

APPENDIX A—Continued.

CAMP No. 133—February 26, 1854—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Saturn	10	47	45.9	70	39	20
	10	48	15.9	70	27	30
	10	48	44.5	70	15	50
	10	49	14.9	70	03	20
	10	49	43.5	69	51	30
α Tauri	10	51	02.0	89	05	40
	10	51	44.1	88	49	10
	10	52	33.8	88	29	20
	10	53	03.5	88	16	50
	10	53	41.8	88	01	40
Polaris	10	54	58.0	69	15	10
	10	55	29.9	69	14	50
	10	55	59.1	69	14	40
	10	56	20.2	69	14	30
	10	56	40.9	69	14	20

Index error + 1′ 50″. Barometer, 29.67 in. Thermometer, 72°.7.

CAMP No. 135—March 1, 1854.

Procyon	8	45	54.5	98	17	10
	8	46	34.6	98	30	00
	8	47	28.6	98	46	50
	8	47	55.9	98	56	40
	8	48	26.0	99	07	10
	8	48	55.7	99	16	20
α Arietis	8	50	31.6	84	30	00
	8	51	27.5	84	07	40
	8	51	54.5	83	55	50
	8	53	49.7	83	10	00
	8	54	32.1	82	51	50
	8	55	05.6	82	38	00
	8	55	33.5	82	26	10
Polaris	8	57	33.5	70	48	20
	8	58	11.4	70	48	10
	8	58	43.4	70	47	30
	8	59	05.5	70	47	10
	8	59	23.4	70	47	00
	8	59	40.0	70	46	50
	8	59	55.6	70	46	30
	9	00	19.9	70	46	10

Index error + 1′ 50″. Barometer, 29.96 in. Thermometer, 41°.7.

CAMP No. 136—March 2, 1854.

Procyon	9	03	29.0	103	05	00
	9	04	24.6	103	20	20
	9	04	55.5	103	30	00
	9	05	15.1	103	35	50
	9	05	40.9	103	42	40
	9	06	07.5	103	51	10

CAMP No. 136—March 2, 1854—Continued.

Object observed.	Time of observ'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
α Arietis	9	09	49.5	87	08	50
	9	10	36.4	86	49	10
	9	11	04.6	86	37	50
	9	11	26.5	86	28	20
	9	11	48.4	86	20	10
	9	12	14.1	86	10	00
Polaris	9	14	45.5	70	54	30
	9	15	27.7	70	54	10
	9	15	53.6	70	54	00
	9	16	20.8	70	53	50
	9	16	46.1	70	53	30

Index error + 1′ 50″. Barometer, 27.89 in. Thermometer, 44°.5.

CAMP No. 137—March 3, 1854.

Polaris	8	57	49.5	71	17	40
	8	58	25.1	71	17	20
	8	58	56.9	71	17	00
	8	59	23.8	71	16	30
	8	59	56.8	71	16	10
	9	00	07.2	71	15	50
α Arietis	9	06	27.6	78	45	20
	9	06	59.5	78	32	10
	9	07	35.6	78	18	00
	9	08	14.5	78	01	40
	9	08	38.4	77	52	10
	9	09	06.8	77	40	00
	9	09	27.5	77	31	20
α Leonis	9	12	28.5	60	08	30
	9	13	20.6	60	29	20
	9	13	49.9	60	41	10
	9	14	13.8	60	51	20
	9	14	35.5	61	00	00
	9	15	03.1	61	11	10
	9	15	22.5	61	19	20

Index error + 1′ 50″. Barometer 27.21 in. Thermometer 44°.6.

CAMP No. 140—March 6, 1854.

Polaris	9	22	35.5	71	11	30
	9	23	11.9	71	11	00
	9	23	35.9	71	10	20
	9	23	54.0	71	09	50
	9	24	16.8	71	09	30
α Leonis	9	26	04.5	64	24	30
	9	26	34.5	64	37	10
	9	27	11.4	64	52	00
	9	27	34.6	65	01	10
	9	27	53.4	65	09	40

APPENDIX A—Continued.

CAMP No. 140—March 6, 1854—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
α Arietis	9	30	57.1	70	01	00
	9	31	33.0	69	46	50
	9	31	56.1	69	37	20
	9	32	16.5	69	27	10
	9	32	35.9	69	21	20
	9	34	05.8	68	44	40

Index error + 1′ 50″. Barometer, 26 in. Thermometer, 35°.5.

CAMP No. 142—March 8, 1854.

Polaris	9	20	58.5	71	02	20
	9	21	31.9	71	01	50
	9	21	50.4	71	01	20
	9	22	07.4	71	01	00
	9	22	27.1	71	00	40
	9	22	50.2	71	00	10
α Leonis	9	25	24.8	63	17	50
	9	26	01.2	63	33	00
	9	26	33.4	63	41	30
	9	27	00.6	63	56	40
	9	27	37.9	64	11	40
	9	28	18.8	64	28	50
α Arietis	9	30	50.1	70	54	50
	9	31	22.5	70	42	20
	9	31	42.5	70	34	00
	9	32	25.0	70	16	50
	9	32	56.0	70	04	00

Index error + 1′ 50″. Barometer, 28.88 in. Thermometer, 46°.

CAMP No. 143—March 9, 1854.

Polaris	11	30	53.5	69	18	50
	11	31	17.7	69	18	20
	11	31	35.0	69	18	10
	11	32	01.0	69	18	00
	11	32	16.1	69	17	50
	11	32	37.4	69	17	40

Index error + 1′ 50″.

CAMP No. 145—March 12, 1854.

Polaris	12	48	24.5	68	13	20
	12	48	55.4	68	13	00
	12	49	17.8	68	12	50
	12	49	38.1	68	12	30
	12	49	54.5	68	12	10

CAMP No. 145—March 12, 1854—Continued.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	*m.*	*s.*	°	′	″
Aurigæ	12	52	41.4	81	54	40
	12	53	20.5	81	41	20
	12	53	49.4	81	31	10
	12	54	22.5	81	20	00
	12	55	35.6	80	55	00
	12	56	26.5	80	36	30
	12	57	04.7	80	24	30
Arcturus	12	59	15.1	55	29	40
	12	59	53.5	55	45	20
	13	00	22.1	55	57	50
	13	00	46.3	56	07	30
	13	01	15.4	56	19	10

Index error + 1′ 50″. Barometer 28.15 in. Thermometer 30°.7.

CAMP No. 146—March 13, 1854.

Polaris	11	46	28.4	68	51	30
	11	47	02.5	68	51	20
	11	47	29.1	68	51	00
	11	47	56.2	68	50	40
	11	48	17.7	68	50	20
Aldebaran	11	50	31.0	69	59	50
	11	51	38.0	69	32	10
	11	52	10.4	69	19	10
	11	52	39.8	69	07	20
	11	53	05.1	68	56	30
Mars	11	55	13.5	113	09	40
	11	56	42.8	113	41	40
	11	57	11.9	113	54	30
	11	57	52.4	114	06	20
	11	58	20.3	114	15	30

Index error + 1′ 50″. Barometer 27.72 in. Thermometer 60°.

CAMP No. 147—March 14, 1854.

Polaris	12	18	59.9	68	15	10
	12	19	35.5	68	15	00
	12	19	53.0	68	14	50
	12	20	10.9	68	14	30
	12	20	28.5	68	14	20
Aldebaran	12	27	24.6	55	30	00
	12	27	44.8	55	21	50
	12	28	04.9	55	13	30
	12	28	24.6	55	06	20
	12	28	43.8	54	57	20
Arcturus	12	30	11.9	42	25	40
	12	30	41.7	42	38	00
	12	31	08.1	42	48	50
	12	31	50.6	43	05	10
	12	32	11.0	43	13	10

Index error + 1′ 50″. Barometer, 27.45 in. Thermometer 46°.5.

APPENDIX A—Continued.

CAMP No. 148—March 15, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Mars	11	09	13.6	96	33	40
	11	09	50.9	96	48	20
	11	10	54.1	97	12	50
	11	11	20.0	97	22	30
	11	11	45.3	97	33	50
Aldebaran	11	13	58.0	85	51	00
	11	14	31.0	85	38	20
	11	15	03.6	85	25	00
	11	15	39.0	85	11	50
	11	16	00.6	85	01	30
Polaris	11	17	54.5	68	22	40
	11	18	24.0	68	22	20
	11	18	50.9	68	22	00
	11	19	10.6	68	21	50
	11	19	36.5	68	21	30
	11	19	59.0	68	21	20

Index error + 1′ 50″. Barometer 27.11 in. Thermometer 38°.8.

CAMP No 150—March 19, 1854.

Polaris	10	50	52.1	68	03	00
	10	51	34.1	68	02	40
	10	51	51.8	68	02	20
	10	52	12.0	68	02	10
	10	52	30.2	68	01	50
Mars	10	55	28.1	92	43	40
	10	56	36.4	93	11	50
	10	57	17.5	93	28	20
	10	58	09.1	93	49	30
	10	58	32.6	93	58	20
α Tauri	11	01	36.5	91	39	40
	11	03	18.1	90	58	30
	11	03	49.4	90	44	20
	11	04	10.9	90	36	50
	11	05	54.4	89	56	00

Index error + 1′ 50″. Barometer 28.8 in. Thermometer 47°.

CAMP No. 152—March 21, 1854.

Object observed.	Time of observat'n by chronometer.			Observed double altitude.		
	h.	m.	s.	°	′	″
Mars	11	27	54.4	105	17	10
	11	30	23.0	106	13	10
	11	31	42.0	106	44	00
α Orionis	11	47	59.0	94	41	10
	11	48	43.8	94	26	00
	11	49	32.5	94	08	30
	11	50	10.1	93	54	50
	11	50	45.1	93	43	00
Polaris	11	56	05.6	67	10	10
	11	59	50.9	67	07	20
	12	01	07.6	67	06	00
	12	02	39.0	67	05	00
	12	04	06.1	67	03	50

Index error + 1′ 50″. Barometer 29.7 in. Thermometer 49°.5.

CAMP No. 152—March 22, 1854.

Polaris	11	16	24.5	67	39	30
	11	17	14.3	67	39	20
	11	18	04.0	67	38	40
	11	18	26.0	67	38	20
	11	18	42.0	67	37	50
	11	19	01.2	67	37	30
Mars	11	19	56.0	102	34	10
	11	20	30.3	102	47	50
	11	20	55.0	102	57	10
	11	21	18.1	103	03	50
	11	21	44.0	103	16	10
	11	22	25.8	103	31	00
Aldebaran	11	38	27.0	69	57	10
	11	40	17.0	69	10	40
	11	41	00.0	68	53	50
	11	41	35.2	68	43	00
	11	42	08.0	68	26	30
Saturn	11	34	11.0	62	58	20
	11	35	06.0	62	34	40
	11	35	36.5	62	22	50
	11	35	59.9	62	14	00
	11	37	05.8	61	46	30

Index error + 1′ 50″. Barometer 29.74 in. Thermometer 51°.5.

APPENDIX B.

ASTRONOMICAL OBSERVATIONS WITH TRANSIT.

CAMP 59—ALBUQUERQUE, N. M., (*left bank of Rio del Norte*)—LATITUDE 35° 5′ 50″.8 N.

Date.	Name of object.	Times of transit over the wires.							Illum'd end of axis.	Reading of level.			
										× end east.		× end west.	
		I.	II.	III.	IV.	V.	VI.	VII.		E.	W.	E.	W.
1853.		*s.*	*s.*	*s.*	*h. m. s.*	*s.*	*s.*	*s.*					
Oct. 17	Polaris				1 6 43.0				W.	100.5	97.5	111.0	100.5
										99.0	101.0	113.0	102.0
	θ′ Ceti (*a*)	17.5	35.9	52.1	1 18 10.2	27.3	46.5		E.	105.0	102.0	117.0	92.0
	α Piscium	54.5	12.9	29.1	1 55 47.1	3.8	22.6	39.6	E.				
	64 Ceti	4.9		39.6	2 4	14.6	33.4	50.6	E.				
	Moon II	44.6	3.5	20.1	2 34 39.0	56.8	16.1	33.7	E.	128.0	93.0	130.0	89.0
	B. A. C. 845	29.4	47.9		2 38 22.0		58.5	16.1	E.				
	π Arietis	35.6	53.8	10.7	2 42 30.2	47.5		24.4	E.				
	α Ceti	4.6	22.9	38.9	2 55 57.2	13.7	32.5	49.5	E.				
	α Persei	6.9	34.6	58.9	3 15 27.1	53.0	21.6	27.5	E.				
18	Polaris				1 8 13.0				W.	114.0	109.0	104.0	119.0
	θ′ Ceti				1 18 11.8	30.4	46.5	4.9	W.	105.0	108.0	100.0	113.0
	α Piscium		22.8	41.6	1 55 58.1	16.5	32.5	50.4	W.				
	α Arietis				2 00	46.0	2.9	22.8	W.				
	ξ′ Ceti	51.9		27.6	2 6 44.5	2.6	19.0	37.5	W.	114.0	106.5	108.0	112.0
	γ Ceti	37.6			2 37				W.				
	π Arietis	43.1	0.9	20.6	2 42 37.9	57.1	13.7	32.8	W.				
	α Ceti	15.4	32.5	51.4	2 56 07.9	26.5	42.6	0.4	W.	119.0	105.0	113.0	112.0
	α Persei		30.6	0.0	3 15 25.5	53.5	17.8	45.6	W.				
	☼ 4th mag. (*b*)		50.9	10.0	3 18 26.9	45.4	1.5		W.				
	☼ 4th mag. (*c*)	51.7	8.9	27.6	3 20 45.0				W.				
	Moon II	53.1	11.5	31.2	3 22 48.9	8.5	25.5	44.6	W.				
	☼ 5th mag. (*d*)	45.0	3.1	24.1	3 37 42.4				W.				
	η Tauri	21.5	39.5	59.6	3 40 18.1	38.5	55.7	15.6	W.				
	32 Tauri	47.9	6.5	26.4	3 49	4.1	21.5	41.0	W.	122.0	106.0	131.0	95.5
	Saturn			25.6	3 57 43.0	2.6			W.				

Date.	Observer.	Sid. chron'r.	Remarks.
October 17	Whipple	No. 2475	(*a*) After observing this star, the instrument was changed in azimuth.
18	Whipple	2475	(*b*) Near path of moon.
			(*c*) 7° south of moon.
			(*d*) Near path of moon.

APPENDIX B—Continued.

CAMP No. 59—ALBUQUERQUE, N. M., (*left bank of Rio del Norte*)—LATITUDE 35° 5′ 50″. 8.

Date.	Name of object.	Times of transit over the wires.							Illum'd end of axis.	Reading of level.			
										× end east.		× end west.	
		I.	II.	III.	IV.	V.	VI.	VIII.		E.	W.	E.	W.
1853.		*s.*	*s.*	*s.*	*h. m. s.*	*s.*	*s.*	*s.*					
Oct. 19	B. A. C. 845	36.5	53.5	12.4	2 38 29.5	47.9	3.8	22 3	W.	108.0	125.0	125.0	110.0
	π Arietis	------	------	------	2 42 36.0	55.5	11.6	30.8	W.	------	------	------	------
	α Ceti	12.6	29.4	47.9	2 56 04.8	22.6	39.6	57.5	W.	------	------	------	------
	α Persei	7.1	32.9	1.8	3 15 27.5	55.5	19.9	47.6	W.	------	------	------	------
	η Tauri	19.9	38.3	58.5	3 40 16.9	37.0	54.1	13.7	W.	------	------	------	------
	γ' Eridani	44.1	1.3	20.2	3 52 37.5	56.5	12.9	31.8	W.	110.0	126.0	130.0	105.0
	Moon II	24.9	43.6	3.9	4 12 22.4	42.6	59.6	19.5	W.	------	------	------	------
	θ' Tauri	54.0	10.6	29.7	4 21 47.1	6.2	22.5	41.4	W.	------	------	------	------
	α Tauri	5.5	22.9	42.6	4 29	19.6	35.9	54.6	W.	------	------	------	------
21	α Aurigæ	10.1	34.4	1.5	5 7 25.2	51.8	14.6	40.5	W.	110.0	130.0	113.0	130.0
	o Tauri	26.9	44.9	5.1	5 20 22.9	42.6	------	19.6	W.	135.0	112.0	100.0	134.0
	δ Orionis	------	------	------	5 25	17.1	------	50.5	W.	------	------	------	------
	ζ' Tauri	27.5	46.0	6.0	5 30 23.5	43.5	0.5	19.8	W.	------	------	------	------
	α Columbæ	39.1	59.5	21.9	5 35 42.5	4.6	23.6	45.5	W.	------	------	------	------
	α Orionis	50.1	6.9	25.9	5 48 42.6	1.4	17.4	35.5	W.	98.0	105.0	116.0	98.0
	Moon II	50.6	9.9	30.9	5 56 49.9	10.5	28.8	49.0	W.	------	------	------	------
	η Geminorum	36.5	54.5	14.9	6 7 33.1	52.8	10.0	30.1	W.	------	------	------	------
	μ Geminorum	40.5	58.5	18.5	6 15 36.9	56.5	13.9	33.5	W.	------	------	------	------
23	α Canis Majoris	------	------	------	6 40 10.0	------	------	------	----	24.0	6.0	31.0	10.0
	ζ Geminorum	12.5	30.6	50.5	6 57 8.5	27.5	45.2	4.6	W.	------	------	------	------
	δ Geminorum	9.6	28.1	48.2	7 13 6.5	26.1	43.5	2.5	W.	------	------	------	------
	a^2 Geminorum	1.1	20.9	43.5	7 27 3.3	24.9	43.9	4.1	W.	------	------	------	------
	α Canis Minoris	------	40.6	59.5	7 33 16.1	34.5	51.0	8.6	W.	------	------	------	------
	β Geminorum	7.6	26.9	48.5	7 38 7.9	28.1	46.1	6.6	W.	------	------	------	------
	Moon II	2.6	21.9	42.5	7 46 1.9	21.9	40.0	1.0	W.	------	------	------	------

CAMP No. 63, (*Rio Rita*)—LATITUDE 35° 01′ 09″. 9.

Nov. 12	γ Cephei (*a*)	------	------	------	2 8 15.5	------	32.6	52.5	W.	------	------	------	------
	α Andromedæ	49.9	9.1	29.7	2 35 48.7	9.0	26.5	47.1	W.	------	------	------	------
	γ Pegasi	49.1	7.1	26.6	2 40 44.1	2.5	18.7	36.6	W.	140.0	113.0	132.0	129.0
	α Cassiopeæ	------	55.1	28.7	3 7 2.5	33.5	2.1	34.1	W.	------	------	------	------
	β Ceti	------	------	------	3 11 21.9	41.2	58.5	17.2	W.	------	------	------	------
	δ Piscium	14.6	32.1	50.5	3 16 8.1	26.3	42.6	0.6	W.	------	------	------	------
	20 Ceti	43.6	59.0*d*	19.6	3 25 36.5	54.5	10.0	28.1	W.	------	------	------	------
	Moon I	45.8	4.2	23.0	4 3 40.2	58.1	14.3	33.2	W.	------	------	------	------
	o Piscium	48.9	6.5	26.0	4 12 42.1	0.3	6.5	35.4	W.	------	------	------	------

CAMP No. 64, (*Covèra*)—LATITUDE 35° 05′ 22″. 1.

Nov. 14	θ' Ceti	------	58.1	17.2	3 52.35.5	52.6	8.5	27.1	W.	133.0	105.0	105.0	134.0
	α Arietis	51.1	9.8	29.5	4 34 48.5	8.1	24.6	44.9	W.	136.0	104.0	117.0	123.0
	ξ^2 Ceti	25.3	42.5	----	4 56 15.7	35.5	51.6	8.1	W.	------	------	------	------

Date.		Observer.	Sid. chron'r.	Remarks.
October	19	Whipple	No. 2475	(*a*) Instrument set on this star.
	21	Ives	2475	
	23	Ives	2475	
November	12	Ives	10	
	14	Ives	10	

APPENDIX B—Continued.

CAMP No. 64, (*Covèra*)—Latitude 35° 05′ 22″. 1—Continued.

Date.	Name of object.	Times of transit over the wires.							Illum'd end of axis.	Reading of level.			
										× end east.		× end west.	
		I.	II.	III.	IV.	V.	VI.	VII.		E.	W.	E.	W.
1853.		*s.*	*s.*	*s.*	*h. m. s.*	*s.*	*s.*	*s.*					
Nov. 14	B. A. C. 845	1.6	18.8	37.7	5 12 54.6	13.5	30.3	48.2	W.	------	------	------	------
	a Ceti	38.1	55.0	13.6	5 30 30.5	48.5	4.6	22.6	W.	------	------	------	------
	Moon I	------	17.6	38.5	5 37 55.6	15.1	31.6	51.2	W.	------	------	------	------
	Moon II	7.0	25.6	45.5	5 40 3.1	22.5	38.8	58.1	W.	------	------	------	------
	a Persei	26.1	52.6	20.4	5 49 46.1	14.4	38.8	5.8	W.	------	------	------	------
	CAMP No. 65—Latitude 35° 04′ 59″. 6.												
Nov. 15	Polaris	------	------	------	3 43 12.0	------	------	------	W.	135.0	124.0	124.0	135.0
	θ' Ceti	39.1	56.1	14.7	5 53 32.3	50.5	7.1	24.5	W.	------	------	------	------
	β Ursæ Minoris	------	------	------	5 27 50.0	------	------	------	W.	------	------	------	------
	a Ceti	------	------	------	5 31	42.3	------	16.8	W.	130.0	140.0	142.0	132.0
	δ Arietis	------	30.4	49.5	5 40 7.6	26.9	43.9	2.5	W.	------	------	------	------
	a Persei	22.1	47.7	15.9	5 50 42.2	10.1	33.9	1.1	W.	------	------	------	------
	Moon I	47.9	6.1	26.5	6 27 44.9	4.5	23.5	40.5	W.	------	------	------	------
	Moon II	56.9	15.5	36.6	6 29 54.5	14.5	31.6	51.1	W.	------	------	------	------
	γ Tauri	26.1	43.9	2.9	6 48 20.0	39.1	55.5	14.1	W.	------	------	------	------
	δ^2 Tauri	27.0	44.7	4.9	6 51 22.5	41.1	57.7	16.9	W.	------	------	------	------
	CAMP No. 82—Latitude 35° 02′ 55″. 5.												
Dec. 9	*a* Andromedæ	47.5	------	38.1	2 50 57.9	17.6	35.8	46.4	W.	------	------	------	------
	a Cassiopeæ	------	------	------	3 22	53.5	20.8	53.3	W.	------	------	------	------
	β Ceti	------	0.5	20.1	3 26 37.8	56.6	11.5	32.5	W.	------	------	------	------
	δ Piscium	31.0	48.5	6.6	3 31 23.3	42.0	57.5	18.5	W.	140.0	118.0	114.0	145.0
	Moon I	------	------	------	4 5	20.5	37.0	52.6	W.	------	------	------	------
	Moon II (*a*)	------	------	------	4 6 40.6	59.5	15.6	33.5	W.	------	------	------	------
	γ Piscium	15.6	32.2	51.4*d*	4 24 10.5	28.6	44.5	2.5	W.	------	------	------	------
	o Piscium	6.2	23.5	42.4	4 27 59.1	17.5	33.5	51.4	W.	------	------	------	------
Dec. 10	Polaris (*b*)	------	------	------	3 56	------	6.0	52.5	W.	------	------	------	------
	γ Piscium	20.5	39.0	54.9	4 24 12.8	29.9	48.3	4.9	W.	------	------	------	------
	o Piscium	11.5	------	45.1	4 28 4.1	21.4	39.9	56.9	W.	------	------	------	------
	a Arietis	23.4	43.1	------	4 49	------	------	------	W.	------	------	------	------
	Moon I	57.9	16.4	32.9	4 50 51.6	9.5	29.6	46.4	W.	------	------	------	------
	ξ^1 Ceti	46.6	5.1	20.6	4 55 39.1	55.5	14.8	31.6	W.	120.0	117.0	116.0	119.0
	ξ^2 Ceti	------	12.9	29.3	5 10 47.4	4.6	23.5	40.1	W.	------	------	------	------
	CAMP No. 85—Latitude 35° 18′ 11″. 7.												
Dec. 18	51 Hev. Cephei (*c*)	------	------	------	9 23 27.0	------	------	------	W.	------	------	------	------
	a Canis Majoris	22.8	40.6	2.6	9 31 27.4	36.3	52.4	11.5	W.	------	------	------	------
	ε Canis Majoris	29.5	48.5	11.7	9 45 27.5	49.2	7.5	28.1	W.	------	------	------	------
	δ Geminorum	2.9	21.5	44.1	10 3 59.4	19.1	36.1	55.5	W.	------	------	------	------

Date.	Observer.	Sid. chron'r.
November 14	Ives	No. 10
15	Ives	10
December 9	Ives	10
10	Ives	10
18	Ives	10

Remarks.

(*a*) Third night after first quarter.
(*b*) Instrument set on 6th wire of Polaris.
(*c*) Instrument set on this star.

APPENDIX B—Continued.

CAMP No. 85—Latitude 35° 18′ 11″.7—Continued.

Date.	Name of object.	Times of transit over the wires. I.	II.	III.	IV.	V.	VI.	VII.	Illum'd end of axis.	Reading of level. × end east. E.	W.	× end west. E.	W.
1853.		*s.*	*s.*	*s.*	*h. m. s.*	*s.*	*s.*	*s.*					
Dec. 18	a^2 Geminorum	51.0	10.9	35.7	10 17 52.1	13.5	33.5	53.9	W.	------	------	------	------
	β Geminorum	------	------	43.4	10 28 58.1	19.5	37.5	58.1	W.	------	------	------	------
	15 Argus	57.0	15.8	39.5	10 53 54.5	14.8	31.9	51.6	W.	------	------	------	------
	d^1 Cancri	------	------	20.5	11 7 34.9	54.1	11.0	30.1	W.	------	------	------	------
	θ Cancri	56.5	14.9	36.5	11 15 51.5	10.9	28.1	47.1	W.	------	------	------	------
	Moon II	35.5	53.9	17.5	11 47 33.4	53.5	11.6	31.2	W.	------	------	------	------
	λ Leonis	1.5	19.9	42.9	12 15 58.4	18.5	35.8	55.6	W.	------	------	------	------

CAMP No. 97—Latitude 35° 18′ 11″.3.

1854.													
Jan. 10	θ' Ceti	------	37.2	56.2	4 18 13.4	31.6	47.6	------	W.	116.0	------	------	116.0
	α Arietis	17.2	35.1	56.0	5 0 14.1	33.7	50.2	10.0	W.	------	------	------	------
	α Ceti	55.1	12.2	31.2	5 55 48.0	6.0	22.6	40.8	W.	------	------	------	------
	β Ursæ Minoris(*a*)	------	------	------	5 52 23.0	------	------	------	W.	------	------	------	------
	α Persei	49.1	15.4	44.0	6 15 10.3	38.3	2.2	29.9	W.	------	129.0	130.0	------
	γ^1 Eridani	25.0	42.0	1.0	6 52 18.6	37.3	53.9	12.8	W.	------	------	------	------
	ε Tauri	20.2	37.6	57.1	7 21 15.0	34.3	51.0	10.6	W.	------	------	------	------
	α Tauri	47.8	5.0	24.2	7 28 42.0	1.0	17.7	36.1	W.	------	------	------	------
	Moon I	23.0	41.2	2.0	8 0 21.0	40.9	58.3	18.1	W.	132.0	140.0	126.0	145.0
	α Aurigæ	55.1	18.0	46.0	8 7 10.0	35.9	58.9	24.0	W.	------	------	------	------
	o Tauri	------	24.0	------	8 20 4.0*d*	22.2	39.1	58.1	W.	------	------	------	------
	ζ Tauri	9.1	27.0	47.0	8 30 5.2	24.4	41.2	0.9	W.	------	------	------	------
11	Polaris (*a*)	------	------	------	4 7 13.0	------	------	------	W.	------	------	------	------
	θ' Ceti	------	32.1	51.2	4 18 8.4	26.3	42.4	1.0	W.	------	113.0	116.0	------
	α Arietis	24.8	43.2	3.1	5 0 21.7	41.5	58.4	18.1	W.	------	------	------	------
	α Aurigæ	------	------	------	8 7 21.1	46.9	9.4	35.3	W.	135.0	------	------	139.0
	β Tauri	31.0	50.1	11.2	8 18 30.6	51.5	9.1	29.7	W.	------	------	------	------
	δ Orionis	7.2	24.0	43.0	8 25 59.7	17.5	33.6	51.9	W.	------	------	------	------
	ε Orionis	23.0	39.9	58.1	8 30 15.1	33.3	49.2	7.0	W.	------	------	------	------
	α Columbæ	46.0	6.2	29.1	8 35 49.2	11.1	30.6	52.3	W.	------	------	------	------
	α Orionis	6.9	6.9	26.0	8 48 42.9	1.0	17.3	35.2	W.	------	------	------	------
	η Geminorum	33.6	51.7	12.1	9 7 30.4	50.0	7.2	27.0	W.	------	------	------	------

CAMP No. 98—Latitude 35° 15′ 55″.3.

Jan. 12	Polaris (*a*)	------	------	------	4 7 34.0	------	------	------	W.	------	------	------	------
	θ' Ceti	------	------	9.9	4 18 27.0	45.4	1.2	20.0	W.	------	------	------	------
	α Arietis	44.5	2.8	23.1	5 0 41.2	1.1	18.3	37.6	W.	119.0	140.0	112.0	147.0
	α Aurigæ	------	------	------	8 7 43.2	9.6	32.2	58.0	W.	135.0	------	------	130.0
	β Tauri	52.0	11.2	32.4	8 18 51.2	12.1	30.5	50.4	W.	------	------	------	------
	δ Orionis	27.1	43.9	3.0	8 26 20.0	38.1	53.9	12.0	W.	------	------	------	------
	ε Orionis	43.0	59.1	18.0	8 30 35.1	53.6	9.2	27.1	W.	------	------	------	------

Date.	Observer.	Sid. chron'r.	Remarks.
December 18	Ives	No. 10	(*a*) Instrument set on this star.
January 10	Ives	10	
11	Ives	10	
12	Ives	10	

APPENDIX B—Continued.

CAMP No. 98—Latitude 35° 15′ 55″.3—Continued.

Date.	Name of object.	Times of transit over the wires. I.	II.	III.	IV.	V.	VI.	VII.	Illum'd end of axis.	Reading of level. × end east. E.	W.	× end west. E.	W.
1854.		s.	s.	s.	h. m. s.	s.	s.	s.					
Jan. 12	α Columbæ	4.6	35.0	------	8 36 7.9	30.0	48.9	11.0	W.	------	------	------	------
	α Orionis	10.1	27.3	46.1	8 49 3.3	21.6	37.9	56.8	W.	------	------	------	------
	η Geminorum	54.2	13.1	33.6	9 7 51.8	11.3	28.3	48.0	W.	------	------	------	------
	☆ 5th mag. (a)	9.6	28.0	47.2	9 22 5.4	25.0	42.0	1.4	W.	------	------	------	------
	Moon I	33.1	51.9	13.0	9 48 32.6	52.9	11.1	31.7	W.	------	------	------	------
	δ Geminorum	15.0	33.1	53.0	10 13 11.8	31.1	48.0	8.0	W.	------	------	------	------
	☆ Bet. 6 & 7 mag. (b)	16.2	35.0	56.5	10 17 15.3	36.2	------	------	W.	------	------	------	------
	ι Geminorum	27.2	47.0	8.2	10 18 27.0	48.0	6.1	26.0	W.	132.0	------	------	142.0
	CAMP No. 115—Latitude 34° 39′ 06″.5 N.												
Feb. 7	γ′ Eridani	------	------	16.0	7 0 33.5	52.1	8 3	27.0	W.	80.0	130.0	80.0	130.0
	α Tauri (c)	59.4	16.7	36.4	7 36 54.0	13.0	29.5	48.0	W.	------	------	------	------
	Ursæ Minoris (d)	------	------	------	------	------	------	------	W.	------	------	------	------
	m Tauri	------	------	53.0	8 8 11.5	29.8	46.5	5.9	W.	------	------	------	------
	α Aurigæ	------	23.9	50.9	8 15 15.1	41.5	4.5	29.9	W.	------	------	------	------
	β Tauri	25.5	44.5	6.1	8 26 25.4	45.8	4.0	24.2	W.	------	------	------	------
	δ Orionis	2.0	18.9	37.1	8 33 55.0	12.6	28.6	46.5	W.	------	------	------	------
	ζ Tauri	20.3	38.5	58.5	8 38 16.5	36.0	53.d	11.9	W.	------	------	------	------
	Moon I	8.0	27.5	48.5	8 42 7.0	28.0	45.5	5.6	W.	------	------	------	------
	136 Tauri	30.9	50.1	10.8	8 53 31.0	58.8	8.9	29.5	W.	------	------	------	------
	CAMP No. 116—Latitude 34° 35′ 36″.9 N.												
Feb. 8	ε Ursæ Minoris (d)	------	------	------	8 10 27.0	------	------	------	W.	------	------	------	------
	α Aurigæ	14.5	38.8	5.9	8 15 30.1	55.7	18.6	44.0	W.	109.0	112.0	112.0	110.0
	β Tauri	39.5	58.5	19.9	8 26 39.1	59.5	18.0	38.5	W	------	------	------	------
	α Leporis	55.8	13.5	33.1	8 35 51.0	10.0	26.9	45.7	W.	------	------	------	------
	ζ Tauri	------	52.2	12.4	8 38 30.5	49.9	7.0	26.5	W.	112.0	114.0	117.0	109.0
	136 Tauri	46.0	4.6	25.8	8 53 44.8	5.6	5.5	44.1	W.	------	------	------	------
	Moon I	26.1	45.4	6.9	9 36 26.0	46.7	5.0	24.9	W.	90.0	135.0	90.0	135.0
	ε Geminorum	------	54.5	15.5	9 44 34.1	54.5	11.9	32.1	W.	------	------	------	------
	ζ Geminorum	9.5	27.6	47.5	10 5 5.6	24.8	42.0	1.6	W.	------	------	------	------
	CAMP No. 117—Latitude 34° 32′ 29″.6 N.												
Feb. 9	α Aurigæ (d)	------	------	------	8 15 42.0	------	------	------	W.	------	------	------	------
	β Orionis	------	------	------	8 17 5.0	------	37.9	56.1	W.	------	------	------	------
	β Tauri	45.5	4.3	25.5	8 26 44.6	5.5	23.4	43.5	W.	------	------	------	------
	α Leporis	52.2	10.0	29.6	8 35 47.3	6.5	23.0	41.9	W.	------	------	------	------
	ζ Tauri	38.0	55.7	16.1	8 38 33.9	54.0	10.9	29.8	W.	------	------	------	------
	α Columbæ	43.5	3.8	26.6	8 43 46.7	8.6	27.8	49.6	W.	95.0	135.0	90.0	140.0
	136 Tauri	50.6	9.6	30.5	8 53 49.6	10.5	28.6	48.5	W.	------	------	------	------
	α Orionis	------	15.9	34.7	8 56 51.5	10.0	26.1	44.5	W.	------	------	------	------
	ε Geminorum	38.5	57.1	17.7	9 44 36.6	56.9	14.1	33.7	W.	------	------	------	------
	ζ Geminorum	9.5	27.4	------	10 5	------	------	------	W.	------	------	------	------
	Moon I	19.9	39.1	0.3	10 31 19.3	39.5	57.9	18.8	W.	102.0	135.0	96.0	140.0
	a^2 Geminorum	------	------	------	10 34	19.8	38.7	------	W.	------	------	------	------
	β Geminorum	4.0	22.7	44.4	10 46 3.7	24.2	42.5	2.7	W.	------	------	------	------

Date.	Observer.	Sid. chron'r.	Remarks.
January 12	Ives	No. 10	(a) Altitude 78° N.
February 7	Ives	10	(b) Altitude 82° 50′ S.
8	Ives	10	(c) Instrument levelled.
9	Ives	10	(d) Instrument set on this star.

APPENDIX B—Continued.

CAMP No. 121—Latitude 34° 16′ 51″.1 N.

Date.	Name of object.	Times of transit over the wires. I.	II.	III.	IV.	V.	VI.	VII.	Illum'd end of axis.	Reading of level. × end east. E.	W.	× end west. E.	W.
1854.		*s.*	*s.*	*s.*	*h. m. s.*	*s.*	*s.*	*s.*					
Feb. 13	*a* Aurigæ	1.0	24.6	51.9	8 16 16.5	41.9	5.4	30.9	W.				
	β Tauri	25.5	45.0	6.1	8 27 25.5	46.5	4.1		W.				
	a Leporis	42.6	0.5	19.9	8 36 37.6	56.8	13.3	32.6	W.				
	a Columbæ				8 44 41.6				W.				
	a Hydræ	54.5	11.5	30.4	12 30 47.1	5.0	21.4		W.				
	θ Ursæ Majoris				12 33 30.0	59.8	25.3		W.	126.0	117.0	118.0	125.0
	ε Leonis		18.6	38.8	12 47 57.7	17.5	34.6	54.8	W.				
	a Leonis	4.6	22.5	41.5	13 10 58.8	17.4	33.8	51.5	W.				
	γ Leonis				13 22	38.0	54.5	13.5	W.				
	Moon II	24.0	41.9	9.9	14 5 19.0	38.4	54.5	13.5	W.				
	γ Leonis	59.5	16.4	34.9	14 7 52.3	10.6	26.5	44.7	W.	112.0	135.0	106.0	140.0
	ι Leonis			24.5	14 26 41.5	0.8	16.6	35.0	W.				

CAMP No. 122—Latitude 34° 12′ 32″.4 N.

Feb. 15	*a* Leporis(*a*)				8 37 28.0				W.				
	a Columbæ		56.9	19.8	8 45 39.9				W.				
	μ Geminorum				9 25 23.0				W.				
	δ Leonis	43.8	1.5	21.4	14 17 39.5	58.8	15.5	34.7	W.				
	β Leonis	2.0	19.9	38.8	14 52 56.5	15.4	31.5	50.2	W.				
	γ Ursæ Majoris	57.5	26.6	58.5	14 57 27.9	58.9	27.5	57.9	W.				
	π Virginis	50.8	7.4	26.9	15 4 43.5	1.6	17.5	35.9	W.				
	o Virginis	13.1	30.5	48.8	15 9 5.9	24.5	40.9	59.0	W.				
	Moon II	49.0	6.5	25.5	15 44 42.6	1.0	17.5	36.1	W.				
	δ Virginis	44.5	1.0	19.9	15 59 36.9	55.4	11.3	29.8	W.				

CAMP No. 143—Latitude 35° 00′ 34″.5 N.

Mareh 9	*δ* Ursæ Minoris(*a*)				9 45 17.0				W.				
	51 Hev. Cephei				9 56 50.9				W.				
	a Canis Majoris	52.8	10.5	29.8	10 4 47.4	6.3	22.8	42.0	W.				
	ε Canis Majoris	57.8	17.0	38.5	10 18 57.7	18.4	36.5	57.5	W.				
	δ Geminorum	34.3			10 37				W.				
	ι Geminorum	47.1	6.5	27.8	10 42 46.5	7.1	25.2	45.5	W.				
	a^2 Geminorum	22.4	42.0	4.3	10 51 24.6	45.5	4.6	26.0	W.				
	a Canis Minoris	53.5	10.6	29.4	10 57 46.1	4.6	20.5	39.0	W.				
	β Geminorum	30.5	49.8	11.0	11 2 30.0	51.3		30.0	W.				
	φ Geminorum	42.0	1.2	21.8	11 10 41.0	1.6	19.1	39.9	W.	111.0	108.0	117.0	101.0
	Moon I	57.1	16.4	37.5	11 20 56.6	17.0	34.7	55.5	W.				

Date.	Observer.	Sid. chron'r.	Remarks.
February 13	Ives	No. 10	(*a*) Instrument set on this star.
15	Ives	10	
Mareh 9	Ives	10	

APPENDIX C.

COMPARISON OF CHRONOMETERS.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.*
				h. m. s.	*h. m. s.*	*h. m. s.*
1853.						
July 6	0	Camp Wilson	257	6 20 35		+ 1 38 22.31
		Do	10	6 10 27.5	0 10 07.5	
		Do	257	6 24 25		
		Do	2492	7 30 1	1 5 36	
July 7	0	Camp Wilson	257	6 18 10		
		Do	10	6 8 7	0 10 3	
		Do	257	6 21 50		
		Do	2492	7 27 34.5	1 5 44.5	
July 8	0	Camp Wilson	257	6 5 33		
		Do	10	5 55 35	0 9 58	
		Do	257	6 9 27.8		
		Do	2492	7 15 20	1 5 52.2	
July 9	0	Camp Wilson	257	5 3 25		
		Do	10	4 53 30	0 9 55	
		Do	257	5 7 40		
		Do	2492	6 13 41.5	1 6 1.5	
July 10	0	Camp Wilson	257	6 47 0		
		Do	10	6 37 15	0 9 45	
		Do	257	6 42 45		
		Do	2492	7 48 58	1 6 13	
July 11	0	Camp Wilson	257	7 54 25		
		Do	10	7 44 45.9	0 9 39.1	
		Do	257	7 58 15		
		Do	2492	9 4 36	1 6 21	
July 12	0	Camp Wilson	257	7 25 5		+ 1 38 39.32
		Do	10	7 15 32.4	0 9 32.6	
		Do	257	7 27 50		
		Do	2492	8 34 17	1 6 27	
July 14	0	Camp Wilson	257	7 28 07.8		
		Do	10	7 18 45	0 9 22.8	
		Do	257	7 27 55.5		
		Do	2492	8 29 40	1 1 44.5	
July 16	1	Ring's Plantation	257	19 6 57.7		+ 1 39 10.05
		Do	10	18 57 50	0 9 7.7	
		Do	257	19 8 13.4		
		Do	2492	20 15 15	1 7 1.6	
July 19	2	Scullyville	257	20 34 55.4		+ 1 39 28.32
		Do	10	20 25 10	0 9 45.4	
		Do	257	20 35 35.7		
		Do	2492	21 43 5	1 7 29.3	
July 23	2	Scullyville	257	19 9 54.9		+ 1 39 33.35
		Do	10	19 1 39.7	0 8 15.2	

* + fast. — slow.

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1853.				*h.* *m.* *s.*	*h.* *m* *s.*	*h.* *m.* *s.*
July 23	2	Scullyville	257	19 12 9.9		
		Do	2492	20 20 6.5	1 7 56.6	
July 27	4	Câche creek	257	19 12 15		+ 1 40 37.7
		Do	10	19 4 49.2	0 7 45.8	
		Do	257	19 10 11.5		
		Do	2492	20 18 25	1 8 13.5	
July 28	4	Câche creek	257	19 8 34.5		+ 1 40 35.89
		Do	2492	20 16 55	1 8 20.5	
		Do	257	19 5 7		
		Do	10	18 57 28	0 7 39	
July 30	6	Câche creek	257	19 31 7.4		+ 1 40 25.12
		Do	10	19 23 43	0 7 24.4	
		Do	257	19 34 35.2		
		Do	2492	20 43 5	1 8 29.8	
July 31	7	Sans Bois creek	257	19 14 15		+ 1 42 6.16
		Do	10	19 6 54.2	0 7 20.8	
		Do	257	19 16 5		
		Do	2492	20 24 39	1 8 34	
Aug. 1	8	Sans Bois creek	257	19 51 0		+ 1 42 35.70
		Do	10	19 58 13.9	0 7 13.9	
		Do	257	20 0 34		
		Do	2492	21 9 15.5	1 8 41.5	
Aug. 2	9	Santa Rita creek	257	19 26 35		+ 1 43 8.74
		Do	10	19 19 26.5	0 7 8.5	
		Do	257	19 28 55		
		Do	2492	20 37 40.1	1 8 45.1	
Aug. 3	9	Santa Rita creek	257	19 12 15		+ 1 43 12.8
		Do	10	19 5 11.2	0 7 3.8	
		Do	257	19 14 25		
		Do	2492	20 23 13.5	1 8 48.5	
Aug. 4	10	La Honda	257	19 25 35		
		Do	10	19 18 40.9	0 6 54.1	
		Do	257	19 27 55		
		Do	2492	20 36 49.1	0 51 5.9	
Aug. 5	11	Gaines's creek	257	19 34 35		+ 1 44 28.9
		Do	10	19 27 47.6	0 6 47.4	
		Do	257	19 32 30		
		Do	2492	20 41 29.4	1 8 59.4	
Aug. 7	13	Branch of Coal creek	257	19 14 52.1		+ 1 45 37.47
		Do	2492	20 24 0	1 9 7.9	
Aug. 8	14	Head of Coal creek	257	19 26 7.5		+ 1 46 9.30
		Do	10	19 19 40	0 6 27.5	
		Do	257	19 23 40.3		
		Do	2492	20 32 55	1 9 14.7	
Aug. 9	15	Shawnee villages	257	19 29 19.6		+ 1 46 48.18
		Do	10	19 23 0	0 6 19.6	
		Do	257	19 27 18.2		
		Do	2492	20 36 40	1 9 21.8	
Aug. 10	16	Shawnee Town	257	19 54 20		+ 1 47 24.63
		Do	10	19 48 5.4	0 6 14.6	
		Do	257	19 50 37		
		Do	2492	21 0 5.1	1 9 28.1	
Aug. 11	17	Branch of Canadian river	257	20 10 2.5		+ 1 47 53.5
		Do	10	20 3 55	0 6 7.5	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1853.				*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
Aug. 11	17	Branch of Canadian river	257	20 13 18.4		
		Do.	2492	21 22 55	1 9 36.6	
Aug. 12	17	Branch of Canadian river	257	19 58 25.2		+ 1 47 52.23
		Do.	10	19 52 25	0 6 0.2	
		Do.	257	19 56 14.9		
		Do.	2492	21 6 0	1 9 45.1	
Aug. 13	17	Branch of Canadian river	257	20 13 28.2		+ 1 47 56.32
		Do.	10	20 7 30	0 5 58.2	
		Do.	257	20 14 53.4		
		Do.	2492	21 24 45	1 9 51.6	
Aug. 14	18	Head of Boggy river	257	20 14 8.5		+ 1 48 45.79
		Do.	10	20 8 15	0 5 53.5	
		Do.	257	20 16 58		
		Do.	2492	21 24 55	1 9 57	
Aug. 15	19	Branch of Topopki creek	257	19 59 41.9	0 5 46.9	+ 1 49 21.27
		Do.	10	19 53 55		
		Do.	257	20 3 9.2		
		Do.	2492	21 13 10	1 10 0.8	
Aug. 16	20	Topopki creek	257	20 32 37.6		+ 1 50 3.50
		Do.	10	20 27 0	0 5 37.6	
		Do.	257	20 34 52.9		
		Do.	2492	19 45 20	1 10 7.1	
Aug. 17	21	Beaversville	257	20 39 53.1		+ 1 50 42.30
		Do.	10	20 34 25	0 5 28.1	
		Do.	257	20 42 57.9		
		Do.	2492	21 53 10	1 10 12.1	
Aug. 18	21	Beaversville	257	20 34 51.5		+ 1 50 45.90
		Do.	10	20 29 30	0 5 21.5	
		Do.	257	20 36 17.8		
		Do.	2492	21 46 35	1 10 17.2	
Aug. 19	21	Beaversville	257	20 55 47.5		
		Do.	10	20 50 35	0 5 12.5	
		Do.	257	20 56 41.2		
		Do.	2492	22 7 3	1 10 21.8	
Aug. 20	21	Beaversville	257	20 27 24.9		+ 1 50 52.44
		Do.	10	20 22 20	0 5 4.9	
		Do.	257	20 28 22.8		
		Do.	2492	21 38 50	1 10 27.2	
Aug. 21	21	Beaversville	257	20 50 26.5		+ 1 50 55.76
		Do.	10	20 45 30	0 4 56.5	
		Do.	257	20 49 30.5		
		Do.	2492	22 0 5	1 10 34.5	
Aug. 22	22	Branch of Canadian river	257	20 14 20.9		
		Do.	10	21 14 30	0 0 9.1	
		Do.	257	21 12 53.8		
		Do.	2492	22 23 30	1 10 36.2	
Aug. 23	23	Branch of Walnut creek	257	20 22 30		+ 1 52 44.33
		Do.	10	20 17 45	0 4 45	
		Do.	257	20 21 29.2		
		Do.	2492	21 32 10	1 10 40.8	
Aug. 24	24	Walnut creek	257	20 35 3		
		Do.	10	20 30 25	0 4 38	
		Do.	257	20 36 44.4		
		Do.	2492	21 47 30	1 10 45.6	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
				h. *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
1853.						
Aug. 25	25	Walnut creek	257	21 15 35.8		+ 1 53 39.62
		Do	10	21 11 0	0 4 35.8	
		Do	257	21 22 10.2		
		Do	2492	22 33 0	1 10 49.8	
Aug. 27	27	Deer creek	257	21 33 52.4		
		Do	10	21 29 30	0 4 22.4	
		Do	257	21 36 0.3		
		Do	2492	22 47 0	1 10 59.7	
Aug. 28	28	Deer Creek spring	257	21 9 25		+ 1 56 5.82
		Do	10	21 5 10	0 4 15	
		Do	257	21 11 59.4		
		Do	2492	22 23 5	1 11 5.6	
Aug. 29	29	Branch of Canadian	257	21 39 42		+ 1 57 26.83
		Do	10	21 35 30	0 4 12	
		Do	257	21 40 29.2		
		Do	2492	22 51 40	1 11 10.8	
Aug. 30	30	Gypsum creek	257	20 19 13		+ 1 58 28.93
		Do	10	20 15 5	0 4 8	
		Do	257	20 19 13		
		Do	2492	21 30 30	1 11 17	
Aug. 31	31	Comet creek	257	20 47 9.6		+ 1 59 19.85
		Do	10	20 43 10	0 3 59.6	
		Do	257	20 45 54.3		
		Do	2492	21 57 20	1 11 25.7	
Sept. 1	32	Silver creek	257	21 10 11.6		+ 2 0 04.95
		Do	10	21 6 15	0 3 56.6	
		Do	257	21 8 35.2		
		Do	2492	22 20 5	1 11 29.8	
Sept. 2	33	Oat creek	257	20 34 53.3		+ 2 1 0.40
		Do	10	20 31 0	0 3 53.3	
		Do	257	20 36 29.1		
		Do	2492	21 48 0	1 11 30.9	
Sept. 3	34	Epsom spring	257	20 52 54.9		+ 2 1 56.76
		Do	10	20 49 5	0 3 49.9	
		Do	257	20 51 9		
		Do	2492	22 2 45	1 11 36	
Sept. 4	35	Sweet Water run	257	21 39 32.9		+ 2 2 42.76
		Do	10	21 35 49	0 3 43.9	
		Do	257	21 40 49		
		Do	2492	22 52 29	1 11 40	
Sept. 5	35	Sweet Water run	257	21 34 45.5		+ 2 2 48.95
		Do	10	21 31 4	0 4 41.5	
		Do	257	21 36 57.1		
		Do	2492	22 48 43	1 11 45.9	
Sept. 6	36	Canadian river	257	22 4 27.6		+ 2 4 6.08
		Do	10	22 0 48	0 3 39.6	
		Do	257	22 7 16		
		Do	2492	23 19 5	1 11 49	
Sept. 7	37	Mouth of Wolf creek	10	22 21 5.4		+ 2 1 27.77
		Do	2492	23 36 33	1 15 27.6	
Sept. 8	38	Mouth of Wine creek	10	21 51 21.9		+ 2 2 47.97
		Do	2492	23 6 50	1 15 28.1	
	9	Mouth of Valley river	10	21 43 30.4		
		Do	2492	22 59 0	1 15 29.6	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1853.				*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
Sept. 10	40	Mouth of Spring creek	10	22 28 33.1		
		Do	2492	23 44 0	1 15 26.9	
Sept. 11	41	Last camp on Canadian river	10	22 24 57.1		+ 2 6 4.55
		Do	2492	23 40 25	1 15 27.9	
Sept. 12	42	White Sandy creek	10	21 47 29		+ 2 7 5.68
		Do	2492	23 3 0	1 15 31	
Sept. 13	42	White Sandy creek	10	22 32 41.4		+ 2 7 16.19
		Do	2492	23 48 16	1 15 34.6	
Sept. 14	43	Shady creek	10	21 42 47.1		+ 2 8 9.96
		Do	2492	22 58 24	1 15 36.9	
Sept. 15	44	Beautiful View creek	10	22 14 35		+ 2 9 24.9
		Do	2492	23 30 16	1 15 41	
Sept. 16	45	Rincon de la Cruz	10	22 23 52.6		
		Do	2492	23 39 37	1 15 44.4	+ 2 10 43.54
Sept. 17	46	Rocky Dell creek	10	23 13 15		+ 2 12 41.51
		Do	2492	24 29 1.6	1 15 46.6	
Sept. 19	47	Cañada de Truxillo	10	21 54 41		+ 2 14 6.39
		Do	2492	23 10 33	1 15 52	
Sept. 20	48	Branch of Tucumcari creek	10	23 21 41		
		Do	2492	0 37 35.1	1 15 54.1	
Sept. 21	49	Tucumcari creek	10	22 27 15.2		+ 2 17 14.28
		Do		23 43 16	1 16 0.8	
Sept. 22	50	Laguna Colorado	10	22 48 34		+ 2 18 43.3
		Do	2492	0 4 40	1 16 06	
Sept. 23	51	Arroyo Cuerbito	10	22 45 35.3		+ 2 19 59.96
		Do	2492	0 1 49	1 16 13.7	
Sept. 24	52	Hurrah creek	10	22 37 17.2		+ 2 20 56.85
		Do	2492	23 53 37	1 16 19.8	
Sept. 25	52	Hurrah creek	10	22 36 32.6		+ 2 20 58.90
		Do	2492	23 53 6	1 16 33.4	
Sept. 27	54	Anton Chico	10	22 0 5.9		
		Do	2492	23 16 48	1 16 42.1	
Sept. 28	54	Anton Chico	10	22 41 56.2		
		Do	2492	23 58 47	1 16 50.8	+ 2 23 1.81
Sept. 29	55	Cañon Blanco	10	23 22 25.9		
		Do	2492	0 39 24	1 16 58.1	
Sept. 30	56	Lagunas	10	22 3 56.2		
		Do	2492	23 21 4	1 17 7.8	
Oct. 1	57	San Pedro Pass	10	23 33 36		
		Do	2492	0 50 50.9	1 17 14.9	
Oct. 2	58	San Antonio	10	23 24 44.1		
		Do	2492	0 42 4	1 17 19.9	
Oct. 3	59	Albuquerque	10	23 34 22		
		Do	2492	0 51 43	1 17 21	
Oct. 4	59	Albuquerque	10	22 53 15.3		+ 2 29 33.62
		Do	2492	0 10 44	1 17 28.7	
Oct. 5	59	Albuquerque	10	23 35 57		+ 2 29 42.70
		Do	2492	0 53 30	1 17 33	
Oct. 6	59	Albuquerque	10	22 35 48.4		+ 2 29 48.67
		Do	2492	23 53 23	1 17 34.6	
Oct. 7	59	Albuquerque	10	22 48 47		
		Do	2492	0 6 30.1	1 17 43.1	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
				h. *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
1853.						
Oct. 17	59	Albuquerque	*1070	18 39 50.1		
		Do	2475	20 25 35	1 45 44.9	+ 0 1 17.12
		Do	719	20 27 20		
		Do	2475	20 27 43.1	0 0 23.1	
		Do	10	22 58 54		
		Do	2475	20 29 33.4	2 29 20.6	
		Do	2475	20 31 56		
		Do	2492	0 19 58.3	3 48 2.3	
Oct. 18	59	Albuquerque	1070	19 13 50.6		
		Do	2475	21 3 45	1 49 54.4	+ 0 1 29.12
		Do	719	21 0 40		
		Do	2475	21 1 0.9	0 0 20.9	
		Do	10	23 35 45.5		
		Do	2475	21 6 25	2 29 20.5	
		Do	2475	21 8 5.5		
		Do	2492	24 56 15	3 48 9.5	
Oct. 19	59	Albuquerque	1070	18 13 55		
		Do	2475	20 7 38.1	1 53 43.1	+ 0 1 26.57
		Do	719	20 10 0		
		Do	2475	20 10 17.8	0 0 17.8	
		Do	10	22 41 5		
		Do	2475	20 11 45	2 29 20	
		Do	2475	20 13 29.5		
		Do	2492	24 1 47	3 48 17.5	
Oct. 20	59	Albuquerque	1070	18 15 25.4		
		Do	2475	20 13 10	1 57 44.6	
		Do	719	20 15 50		
		Do	2475	20 16 8.9	0 18 9	
		Do	10	22 45 29.5		
		Do	2475	20 16 8.9	2 29 20.6	
		Do	2475	20 13 10		
		Do	2492	24 1 35.5	3 48 25.5	
Oct. 21	59	Albuquerque	1070	18 19 44.5		
		Do	2475	20 21 29	2 1 44.5	+ 0 1 27
		Do	719	20 22 50		
		Do	2475	20 23 4.5	0 0 14.6	
		Do	10	22 53 57		
		Do	2475	20 24 35	2 29 22	
		Do	2475	20 26 10		
		Do	2492	0 14 42.1	3 48 32.1	
Oct. 22	59	Albuquerque	1070	18 14 36		
		Do	2475	20 20 21.2	2 5 45.2	
		Do	719	20 17 6		
		Do	2475	20 17 18.5	0 0 12.5	
		Do	10	22 46 39.5		
		Do	2475	20 17 18.5	2 29 21	
		Do	2475	20 20 21.2		
		Do	2492	0 8 59.5	3 48 38.3	
Oct. 23	59	Albuquerque	1070	18 32 25		
		Do	2475	20 42 19.5	2 9 54.5	+ 0 1 37.10
		Do	719	20 44 20		
		Do	2475	20 44 36.1	0 0 16.1	

* Chronometer 1070 runs nearly upon mean solar time.

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1853.				*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
Oct. 23	59	Albuquerque	10	23 11 31		+ 0 1 37.10
		Do.	2475	20 42 19.5	2 29 11.5	
		Do.	2492	0 33 15.8		
		Do.	2475	20 44 36.1	3 48 39.7	
Oct. 24	59	Albuquerque	1070	18 10 20		
		Do.	2475	20 24 9.4	2 13 49.4	
		Do.	719	20 27 10		
		Do.	2475	20 27 23.1	0 0 13.1	
		Do.	10	22 56 33.5		
		Do.	2475	20 27 23.1	2 29 10.4	
		Do.	2475	20 24 44.4		
		Do.	2492	0 13 31.2	3 48 46.8	
Oct. 25	59	Albuquerque	1070	17 57 30		
		Do.	2475	20 15 10	2 17 40	
		Do.	719	20 16 50		
		Do.	2475	20 16 51.2	0 0 1.2	
		Do.	10	22 44 29.8		
		Do.	2475	20 15 10	2 29 19.8	
		Do.	2475	20 16 51.2		
		Do.	2492	0 5 53.5	3 49 2.3	
Oct. 26	59	Albuquerque	1070	17 57 10		
		Do.	2475	20 18 51.2	2 21 41.2	
		Do.	719	20 20 50		
		Do.	2475	20 20 46	0 0 4	
		Do.	10	22 48 11.5		
		Do.	2495	20 18 51.2	2 29 20.3	
		Do.	2475	20 20 46		
		Do.	2492	0 9 58	3 49 12	
Oct. 27	59	Albuquerque	1070	17 53 20		
		Do.	2475	20 19 5.7	2 25 45.7	
		Do.	719	20 27 0		
		Do.	2475	20 26 56.2	0 0 3.8	
		Do.	10	22 48 28.5		
		Do	2475	20 19 5.7	2 29 22.8	
		Do.	2475	20 26 56.2		
		Do.	2492	0 16 12	3 49 15.8	
Oct. 28	59	Albuquerque	1070	6 3 53.9		
		Do.	719	20 33 50	14 29 56.1	
		Do.	1070	6 0 41.5		
		Do.	10	22 59 54.5	16 59 13	
		Do.	1070	6 0 41.5		
		Do.	2492	0 19 55	18 19 13.5	
Oct. 29	59	Albuquerque	1070	6 4 59.4		
		Do.	719	20 39 0	14 34 0.6	
		Do.	1070	6 2 32.5		
		Do.	10	23 5 48.5	17 3 16	
		Do.	1070	6 2 32.5		
		Do.	2492	0 25 55	18 23 22.5	
Oct. 30	59	Albuquerque	1070	17 59 58.1		
		Do.	719	20 38 0	2 38 1.9	
		Do.	1070	17 59 58.1		
		Do.	10	23 7 13.5	5 7 15.4	
		Do.	1070	18 1 41.2		
		Do.	2492	0 29 11	6 27 29.8	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
				h. m. s.	*h. m s.*	*h. m. s.*
1853.						
Oct. 31	59	Albuquerque	2475	21 59 59		+ 0 1 44.6
		Do.	2492	25 49 50	3 49 51	
		Do.	2475	22 1 1.2		
		Do.	10	24 30 36	2 29 34.8	
		Do.	2475	22 1 50.1		
		Do.	719	22 2 10	0 19.9	
		Do.	2475	22 11 46.2		
		Do.	1070	19 29 45	2 42 1.2	
Nov. 1	59	Albuquerque	2475	21 9 30		
		Do.	2492	0 57 32	3 50 2	
		Do.	2475	21 8 15		
		Do.	10	23 37 55.6	2 29 40.6	
		Do.	2475	21 9 35		
		Do.	1070	18 23 48.1	2 45 46.9	
		Do.	2475	21 10 46		
		Do.	719	21 11 8.3	0 0 22.3	
Nov. 2	59	Albuquerque	2475	20 53 37.8		
		Do.	2492	0 43 50	3 50 12.2	
		Do.	2475	20 55 1		
		Do.	10	23 24 45	2 29 44	
		Do.	2475	20 56 5.5		
		Do.	1070	18 6 25	2 49 40.5	
		Do.	2475	20 57 0.5		
		Do.	719	20 57 20	0 0 19.5	
Nov. 3	59	Albuquerque	2475	21 16 56.7		
		Do.	1070	18 23 16	2 53 40.7	
		Do.	2475	21 16 56.7		
		Do.	719	21 17 20	0 0 23.3	
		Do.	2475	21 10 55		
		Do.	10	23 40 44.5	2 29 49.5	
		Do.	2475	21 11 52		
		Do.	2492	1 2 15.2	3 50 23.2	
Nov. 4	59	Albuquerque	2475	20 25 35		+ 0 1 51.80
		Do.	1070	17 28 5	2 57 30	
		Do.	2475	20 27 29.7		
		Do.	719	20 27 50	0 0 20.3	
		Do.	2475	20 27 29.7		
		Do.	10	22 57 21.5	2 29 51.8	
		Do.	2475	20 25 35		
		Do.	2492	0 16 5	3 50 30	
Nov. 5	59	Albuquerque	2475	20 48 9.7		
		Do.	1070	17 46 35	3 1 34.7	
		Do.	2475	20 49 57.4		
		Do.	719	20 50 20	0 0 22.6	
		Do.	2475	20 45 56		
		Do.	10	23 15 55	2 29 59	
		Do.	2475	20 47 10		
		Do.	2492	0 37 50	3 50 40	
Nov. 6	59	Albuquerque	2475	20 35 3		
		Do.	1070	17 29 33	3 5 33	
		Do.	2475	20 36 57.1		
		Do.	719	20 37 20	0 0 22.9	
		Do.	2475	20 35 3		
		Do.	10	23 5 3.8	2 30 0.8	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1853.				*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
Nov. 6	59	Albuquerque	2475	20 36 57.1		
		Do	2492	0 27 43.5	3 50 46.4	
Nov. 9	61	Isleta	10	2 10 3.6		
		Do	2492	3 30 55	1 20 51.4	
		Do	10	2 11 34.5		
		Do	1070	8 23 20	6 11 45.5	
Nov. 10	62	Rio Puerco	10	8 37 1.5	----------	+ 2 33 33.92
		Do	2492	9 58 0	1 20 58.5	
		Do	10	8 39 48.5		
		Do	1070	2 46 25	5 53 23.5	
Nov. 11	63	Rio San José	10	3 11 38.1	----------	+ 2 34 53.18
		Do	2492	4 32 40	1 21 1.9	
		Do	10	3 15 57.1		
		Do	1070	9 19 25	6 3 27.9	
Nov. 12	63	Rio San José	10	4 56 21	----------	+ 2 34 53.50
		Do	2492	6 17 25	1 21 4	
		Do	10	4 58 21.5		
		Do	1070	10 57 30	5 59 08.5	
Nov. 14	64	Covero	10	6 3 17.8	----------	+ 2 35 51.60
		Do	2492	7 24 20	1 21 12.2	
		Do	10	6 4 25.5		
		Do	1070	11 55 15	5 50 49.5	
Nov. 15	65	Hay Camp	10	6 16 47.8	----------	+ 2 36 49.2
		Do	2492	7 38 5	1 21 17.2	
		Do	10	6 15 31		
		Do	1070	12 2 15	5 46 44	
Nov. 16	66	Sierra Madre	10	0 25 55	----------	+ 2 37 48.20
		Do	2475	21 54 57.1	2 30 57.9	
		Do	10	0 29 0.1		
		Do	719	21 58 20	2 30 40.1	
		Do	10	0 25 55		
		Do	2492	1 47 15	1 21 20	
		Do	10	0 29 0.1		
		Do	1070	18 12 41	6 16 19.1	
Nov. 17	67	Agua Fria	10	0 28 30.2	----------	+ 2 38 14.95
		Do	2475	21 57 26.7	2 31 3.5	
		Do	10	0 32 39.1		
		Do	719	22 2 0	2 30 39.1	
		Do	10	0 32 39.1		
		Do	2492	1 54 7	1 21 27.9	
		Do	10	0 31 35		
		Do	1070	18 11 15.7	6 20 20.3	
Nov. 18	68	Inscription Rock, (El Moro)	10	0 50 50	----------	+ 2 39 24.94
		Do	2475	22 19 40	2 31 10	
		Do	10	0 55 7.1		
		Do	719	22 24 30	2 30 37.1	
		Do	10	0 55 7.1		
		Do	2492	2 16 37.5	1 21 30.4	
		Do	10	0 53 35		
		Do	1070	18 29 11.5	6 24 23.5	
Nov. 19	69	Ojo del Pescado	10	0 5 32.4	----------	+ 2 40 22.58
		Do	2475	21 34 20	2 31 12.4	
		Do	10	0 7 33.4		
		Do	719	21 37 0	2 30 33.4	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1853.				*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
Nov. 19	69	Ojo del Pescado	10	0 8 33		
		Do	2492	1 30 10	1 21 37	
		Do	10	0 6 27.1		
		Do	1070	17 38 15	6 28 12.1	
Nov. 21	70	Zuñi river	10	0 42 8		+ 2 41 20.8
		Do	2475	22 10 30	2 31 38	
		Do	10	0 40 23.5		
		Do	719	22 9 40	2 30 43.5	
		Do	10	0 38 0.6		
		Do	2492	1 59 40	1 21 39.4	
		Do	10	0 39 16.1		
		Do	1070	18 2 50	6 36 26.1	
Nov. 22	70	Zuñi river	10	0 39 5		+ 2 41 34.10(*d*)
		Do	2475	22 7 24.5	2 31 30.5	
		Do	10	0 42 53.1		
		Do	719	22 12 10	2 30 43.1	
		Do	10	0 41 40		
		Do	2492	2 3 26.8	1 21 46.8	
		Do	10	0 40 10		
		Do	1070	17 59 42.5	6 40 27.5	
Nov. 23	70	Zuñi river	10	0 46 0		+ 2 41 26.35
		Do	2475	22 13 58	2 32 2	
		Do	10	0 48 10		
		Do	719	22 17 28.4	2 30 41.6	
		Do	10	0 46 0		
		Do	2492	2 7 55	1 21 55	
		Do	10	0 48 10		
		Do	1070	18 4 43.7	6 43 26.4	
Nov. 24	70	Zuñi river	10	1 4 35		+ 2 41 39.75(*d*)
		Do	2475	22 32 30.4	2 32 04.6	
		Do	10	1 5 23.5		
		Do	719	22 34 40	2 30 43.5	
		Do	10	1 3 40		
		Do	2492	2 25 43.5	1 22 3.5	
		Do	10	1 5 23.5		
		Do	1070	6 16 54.8	5 11 31.2	
Nov. 25	70	Zuñi river	10	1 24 10		+ 2 41 30.94
		Do	2492	2 46 20.5	1 22 10.5	
		Do	10	1 22 45		
		Do	1070	6 30 14	5 7 29	
Nov. 28	72	Cedar Forest	10	0 29 20		+ 2 42 46.09
		Do	2475	21 57 4.8	2 32 15.2	
		Do	10	0 32 30.5		
		Do	719	22 1 40	2 30 50.5	
		Do	10	0 29 20		
		Do	2492	1 51 43	1 22 23	
		Do	10	0 34 30		
		Do	1070	5 29 52	4 55 22	
Nov. 29	73	Jacob's Well	10	4 10 35		+ 2 44 11.01
		Do	2475	1 38 8	2 32 27	
		Do	10	4 12 15		
		Do	719	1 41 20.4	2 30 54.7	
		Do	10	4 10 35		
		Do	2492	5 32 59.5	1 22 24.5	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1853.				h. m. s.	h. m. s.	h. m. s.
Nov. 29	73	Jacob's Well	10	4 12 15		
		Do	1070	9 2 55	4 50 40	
Nov. 30	74	Navajo spring	10	1 30 50		+ 2 44 37.91
		Do	2475	22 31 22	2 32 28	
		Do	10	1 12 6		
		Do	719	22 41 10	2 30 56	
		Do	10	1 6 30		
		Do	2492	2 28 59	1 22 29	
		Do	10	1 3 50		
		Do	1070	5 50 57	4 47 7	
Dec. 1	75	Carriso creek	10	1 29 20		+ 2 45 31.93
		Do	2475	22 56 41.2	2 32 38.8	
		Do	10	1 31 1		
		Do	719	23 0 0	2 31 1	
		Do	10	1 29 20		
		Do	2492	2 51 51	1 22 31	
		Do	10	1 31 1		
		Do	1070	6 13 55	4 42 55	
Dec. 2	76	Near Lithodendron creek	10	1 1 30		+ 2 46 12.30
		Do	2475	22 28 42.2	2 32 47.8	
		Do	10	1 4 5		
		Do	719	23 33 0	1 31 5	
		Do	10	1 1 30		
		Do	2492	3 24 5.5	2 22 35.5	
		Do	10	1 4 5.7		
		Do	1070	5 42 51	4 38 46.3	
Dec. 3	77	Near Rio Puerco of the West	10	3 16 10		+ 2 47 2.22
		Do	2475	0 43 15.1	2 32 54.9	
		Do	10	3 18 17		
		Do	719	0 47 10	2 31 7	
		Do	10	3 16 10		
		Do	2492	4 38 50	1 22 40	
		Do	10	3 18 17		
		Do	1070	7 52 47.5	4 34 30.5	
Dec. 5	78	Little Colorado	10	1 4 0		+ 2 47 56.41
		Do	2475	22 30 56.5	2 33 3.5	
		Do	10	1 5 45.4		
		Do	719	22 34 30	2 31 15.4	
		Do	10	1 4 0		
		Do	2492	2 26 47	1 22 47	
		Do	10	1 5 45.4		
		Do	1070	5 32 32.8	4 26 47.4	
Dec. 6	79	Little Colorado	10	3 58 55		+ 2 48 56.64
		Do	2475	1 25 39.4	2 33 15.6	
		Do	10	4 0 54.3		
		Do	719	1 29 30	2 31 24.3	
		Do	10	3 58 55		
		Do	2492	5 21 43	1 22 48	
		Do	10	4 0 54.3		
		Do	1070	8 23 5.5	4 22 11.2	
Dec. 7	80	Little Colorado	10	2 4 40		+ 2 49 36.55
		Do	2475	23 31 20.1	2 33 19.9	
		Do	10	2 6 33.2		
		Do	719	23 35 0	2 31 33.2	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1853.				*h. m. s.*	*h. m. s.*	*h. m. s.*
Dec. 7	80	Little Colorado.	10	2 4 40		
		Do	2492	3 27 25	1 22 45	
		Do	10	2 11 45		
		Do	1070	6 30 7.5	4 18 22.5	
Dec. 8	81	Little Colorado	10	2 35 0		+ 2 50 1.98
		Do	2475	0 1 29	2 33 31	
		Do	10	2 36 50		
		Do	719	0 5 6.4	2 31 43.6	
		Do	10	2 35 0		
		Do	2492	3 57 45	1 22 45	
		Do	10	2 36 50		
		Do	1070	6 50 58.8	4 14 8.8	
Dec. 9	82	Little Colorado	10	4 39 0		+ 2 50 14.23
		Do	2475	2 5 25	2 33 35	
		Do	10	4 42 20		
		Do	719	2 10 31.2	2 31 48.8	
		Do	10	4 39 0		
		Do	2492	6 1 47.5	1 22 47.5	
		Do	10	4 41 15		
		Do	1070	8 50 58.5	4 9 43.5	
Dec. 10	82	Little Colorado	10	2 2 30		+ 2 50 23.15
		Do	2475	23 28 51.9	2 33 38.1	
		Do	10	2 4 55		
		Do	719	23 33 4	2 31 51	
		Do	10	2 2 30		
		Do	2492	3 25 18	1 22 48	
		Do	10	2 4 55		
		Do	1070	6 10 58.5	4 6 3.5	
Dec. 11	82	Little Colorado	10	2 27 30		
		Do	2475	23 53 52.4	2 33 37.6	
		Do	10	2 29 10		
		Do	719	23 57 18.8	2 31 51.2	
		Do	10	2 27 30		
		Do	2492	3 50 21	1 22 51.2	
		Do	10	2 29 10		
		Do	1070	6 31 6	4 1 56	
Dec. 12	82	Little Colorado	10	2 8 45		
		Do	2475	23 34 56.8	2 33 48.2	
		Do	10	2 10 40		
		Do	719	23 38 48	2 31 52	
		Do	10	2 8 45		
		Do	2492	3 31 40.5	1 23 5.5	
		Do	10	2 10 40		
		Do	1070	6 8 34	3 57 54	
Dec. 14	83	Little Colorado	10	2 1 15		+ 2 50 51.93
		Do	2475	23 27 5.4	2 34 9.6	
		Do	10	2 2 50.5		
		Do	719	23 30 50	2 32 0.5	
		Do	10	2 5 15		
		Do	2492	3 28 20.5	1 23 5.5	
		Do	10	2 4 0		
		Do	1070	5 53 43.7	3 49 43.7	
Dec. 16	84	Little Colorado	10	3 25 35		+ 2 51 27.25
		Do	2475	0 50 58.4	2 34 36.6	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
				h. m. s.	h. m. s.	h. m. s.
1853.						
Dec. 16	84	Little Colorado	10	3 27 40		
		Do.	719	0 55 22.2	2 32 17.8	
		Do.	10	3 28 40		
		Do.	2492	4 51 43.5	1 23 3.5	
		Do.	10	3 25 35		
		Do.	1070	7 6 47.6	3 41 12.6	
Dec. 17	85	Little Colorado	10	4 5 25		+ 2 52 26.76
		Do.	2475	1 30 34	2 34 51	
		Do.	10	4 8 20		
		Do.	719	1 35 51.6	2 32 28.4	
		Do.	10	4 5 25		
		Do.	2492	5 28 20.5	1 22 55.5	
		Do.	10	4 8 20		
		Do.	1070	7 45 12	3 36 52	
Dec. 18	85	Little Colorado	10	4 31 40		+ 2 52 35.83
		Do.	2475	1 56 37.2	2 35 2.8	
		Do.	10	4 32 40		
		Do.	719	2 0 1.9	2 32 38.1	
		Do.	10	4 36 10		
		Do.	2492	5 59 6	1 22 56	
		Do.	10	4 35 0		
		Do.	1070	8 7 40.1	2 32 40.1	
Dec. 19	86	Little Colorado	10	2 39 40		
		Do.	2475	0 4 28.1	2 35 11.9	
		Do.	10	2 38 25		
		Do.	719	0 5 37.2	2 32 47.8	
		Do.	10	2 35 40		
		Do.	2492	2 58 32.6	1 22 52.6	
		Do.	10	2 37 15		
		Do.	1070	6 6 3.2	3 28 48.2	
Dec. 20	87	Little Colorado	10	4 25 10		+ 2 52 49.74
		Do.	2475	1 49 43.5	3 35 27.5	
		Do.	10	4 22 50		
		Do.	719	1 49 51.6	2 32 58.4	
		Do.	10	4 20 30		
		Do.	2492	5 43 25.5	1 22 55.5	
		Do.	10	4 21 45		
		Do.	1070	7 46 10.9	3 24 25.9	
Dec. 23	89	Cosnino Caves	10	6 20 5		+ 2 54 53.10
		Do.	2475	3 44 19.4	2 35 45.6	
		Do.	10	6 20 40		
		Do.	719	3 47 26.8	2 33 13.2	
		Do.	10	6 22 50		
		Do.	2492	7 45 57	1 23 7	
		Do.	10	6 23 40		
		Do.	1070	9 35 25.2	2 11 45.2	
Dec. 24	89	Cosnino Caves	10	4 1 50		+ 2 55 4.06
		Do.	2475	1 25 43.5	2 36 6.5	
		Do.	10	4 0 45		
		Do.	719	1 27 16.8	2 33 28.2	
		Do	10	3 58 15		
		Do.	2492	5 21 17	2 23 2	
		Do.	10	3 59 15		
		Do.	1070	7 7 14	3 7 59	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Differenee.	Chron. fast or slow of sidereal time.
				h. m. s.	h. m. s.	h. m. s.
1853.						
Dec. 27	91	Leroux spring	10	5 16 55.6		+ 2 56 40.64
		Do.	2475	2 40 25	2 36 35.6	
		Do.	10	5 18 3.5		
		Do.	719	2 44 10	2 33 53.4	
		Do.	10	5 13 1.6		
		Do.	2492	6 36 0	1 22 58.4	
		Do.	10	5 14 55.1		
		Do.	1070	8 10 10	2 55 14.9	
Dec. 28	91	Leroux spring	10	4 15 5		+ 2 56 47.02
		Do.	2475	1 38 30.5	2 36 34.5	
		Do.	10	4 18 50		
		Do.	719	1 44 51.6	2 33 58.4	
		Do.	10	4 16 35		
		Do.	2492	5 39 39.9	1 23 4.9	
		Do.	10	4 17 40		
		Do.	1070	7 8 56.5	2 51 16.5	
Dec. 29	91	Leroux spring	10	4 15 50		+ 2 56 57.06
		Do.	2475	1 38 56.1	2 36 53.9	
		Do.	10	4 13 40		
		Do.	719	1 39 33.7	2 34 6.3	
		Do.	10	4 11 20		
		Do.	2492	5 34 17.7	1 22 57.7	
		Do.	10	4 12 30		
		Do.	1070	6 59 36.9	2 47 6.9	
Dec. 30	91	Leroux spring	10	4 49 10		
		Do.	2475	2 12 10.5	2 26 59.5	
		Do.	10	4 47 50		
		Do.	719	2 13 40.8	2 34 9.2	
		Do.	10	4 45 40		
		Do.	2492	6 8 33.5	1 22 53.5	
		Do.	10	4 47 0		
		Do.	1070	7 29 58.5	2 42 58.5	
Dec. 31	92	San Francisco Forest	10	5 47 55		
		Do.	2475	3 10 42	2 37 13	
		Do.	10	5 47 0		
		Do.	719	3 12 40.9	2 34 19.1	
		Do.	10	5 44 55		
		Do.	2492	7 7 45.5	1 22 50.5	
		Do.	10	5 46 5		
		Do.	1070	8 24 40	2 38 35	
1854.						
Jan. 1	93	San Francisco Forest	10	5 46 10		
		Do.	2475	3 8 52.4	2 37 17.6	
		Do.	10	5 45 0		
		Do.	719	3 10 36.8	2 34 23.2	
		Do.	10	5 43 10		
		Do.	2492	7 6 4.5	1 22 54.5	
		Do.	10	5 44 0		
		Do.	1070	8 18 30.5	2 34 30.5	
Jan. 2	94	New Year's spring	10	5 22 25		+ 2 58 55.58
		Do.	2475	2 42 2.5	2 37 22.5	
		Do.	10	5 21 35		
		Do.	719	2 47 7.2	2 34 27.8	
		Do.	10	5 20 5		
		Do.	2492	6 42 57.5	1 22 52.5	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1854.				*h. m. s.*	*h. m. s.*	*h. m. s.*
Jan. 2	94	New Year's spring	10	5 20 50		
		Do.	1070	7 51 19	2 30 29	
Jan. 3	94	New Year's spring	10	4 39 55		
		Do.	2475	2 2 26.4	2 37 28.6	
		Do.	10	4 38 25		
		Do.	719	2 3 52.8	2 34 32.2	
		Do.	10	4 36 30		
		Do.	2492	5 59 20.6	1 22 50.6	
		Do.	10	4 37 30		
		Do.	1070	7 3 57	2 26 27	
Jan. 4	94	New Year's spring	10	4 40 45		
		Do.	2475	2 3 13.8	2 37 31.2	
		Do.	10	4 39 45		
		Do.	719	2 5 8.7	2 34 36.3	
		Do.	10	4 38 5		
		Do.	2492	6 0 58.1	1 22 53.1	
		Do.	10	4 38 55		
		Do.	1070	7 1 16.2	2 22 21.2	
Jan. 6	94	New Year's spring	10	4 35 0		+ 2 59 6.47
		Do.	2475	1 57 12	2 37 48	
		Do.	10	4 37 17.2		
		Do.	719	2 2 30	2 34 47.2	
		Do.	10	4 50 15		
		Do.	2492	6 13 7.4	1 22 52.4	
		Do.	10	4 51 45		
		Do.	1070	7 5 57	2 14 12	
Jan. 9	96	Cedar creek	10	6 47 35		+ 3 0 9.42
		Do.	2475	4 9 22.9	2 38 12.1	
		Do.	10	6 46 50		
		Do.	719	8 29 52	1 43 0.2	
		Do.	10	6 44 45		
		Do.	2492	8 7 32.2	1 22 47.2	
		Do.	10	6 45 50		
		Do.	1070	8 47 15	2 2 35	
Jan. 10	97	Partridg creek	10	8 10 48.9		+ 3 1 6.76
		Do.	2475	6 2 25	2 38 23.9	
		Do.	10	8 42 33		
		Do.	719	10 25 30	1 42 57	
		Do.	10	8 43 54		
		Do.	2492	10 6 40	1 22 46	
		Do.	10	8 39 48		
		Do.	1070	10 39 45	1 56 57	
Jan. 11	97	Partridge creek	10	5 11 4		+ 3 1 26.2
		Do.	2475	2 32 20	2 38 44	
		Do.	10	5 9 4		
		Do.	719	6 51 50	1 42 46	
		Do.	10	5 7 52		
		Do.	2492	6 30 30	1 22 38	
		Do.	10	5 10 22.3		
		Do.	1070	7 3 40	1 53 17.7	
Jan. 12	98	Partridge creek	10	6 4 10		+ 3 1 46.49
		Do.	2475	3 25 7.7	2 39 2.3	
		Do.	10	6 4 55		
		Do.	719	7 47 32.1	1 42 37.1	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
				h. *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
1854.						
Jan. 12	98	Partridge creek	10	6 3 5.5		
		Do	2492	7 25 50	1 22 35.5	
		Do	10	6 6 15		
		Do	1070	7 55 7.7	1 48 52.7	
Jan. 15	99	Picacho spring	10	5 53 40		+ 3 3 26.47
		Do	2475	3 14 7	2 39 33	
		Do	10	5 54 47.9		
		Do	719	7 37 6	1 42 18.1	
		Do	10	5 52 10		
		Do	2492	7 14 35	1 22 25	
		Do	10	5 52 50		
		Do	1070	7 29 4.7	1 36 14.7	
Jan. 17	100	Picacho spring	10	5 27 45		+ 3 3 41.55
		Do	2475	2 47 33	2 40 12	
		Do	10	5 26 50		
		Do	719	7 8 58.4	1 42 8.4	
		Do	10	5 25 15		
		Do	2492	6 47 39	1 22 24	
		Do	10	5 25 55		
		Do	1070	6 53 58.1	1 28 3.1	
Jan. 20	102	Turkey creek	10	5 31 20		+ 3 3 59.58
		Do	2475	2 50 53.5	2 40 26.5	
		Do	10	5 33 51.8		
		Do	719	7 15 40.4	1 41 48.4	
		Do	10	5 31 20		
		Do	2492	6 53 45	1 22 25	
		Do	10	5 33 51.8		
		Do	1070	6 49 30	1 15 38.2	
Jan. 21	103	Pueblo creek	10	6 0 45		+ 3 4 14.23
		Do	2475	3 19 49	2 40 56	
		Do	10	6 1 35		
		Do	719	7 43 8	1 41 33	
		Do	10	5 54 35		
		Do	2492	7 16 56.9	1 22 21.9	
		Do	10	5 53 35		
		Do	1070	7 4 57.5	1 11 22.5	
Jan. 22	104	Aztec Pass	10	5 45 25		+ 3 4 40.68
		Do	2475	3 4 16.7	2 41 8.3	
		Do	10	5 44 47.5		
		Do	719	7 25 40	1 40 52.5	
		Do	10	5 40 45		
		Do	2492	7 2 58.6	1 22 13.6	
		Do	10	5 41 50		
		Do	1070	6 49 0.9	1 7 10.9	
Jan. 23	105	Bill Williams's Fork	10	8 33 35		+ 3 5 14.15
		Do	2475	5 52 18.5	2 41 16.5	
		Do	10	8 28 23.4		
		Do	719	10 9 40	1 41 16.6	
		Do	10	8 25 0		
		Do	2492	9 47 13	1 22 13	
		Do	10	8 26 45		
		Do	1070	9 29 14.5	1 2 29.5	
Jan. 24	106	Bill Williams's Fork	10	6 20 35		+ 3 5 43.84
		Do	2475	3 39 11.1	2 41 23.9	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1854.				*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
Jan. 24	106	Bill Williams's Fork	10	6 18 50		
		Do	719	8 0 3.2	1 41 13.2	
		Do	10	6 16 55		
		Do	2492	7 39 9.6		
		Do	10	6 17 55		
		Do	1070	7 16 41.1		
Jan. 27	107	Bill Williams's Fork	10	7 15 30		+ 3 6 37.24
		Do	2475	4 33 36.2	2 41 53.8	
		Do	10	7 16 56.8		
		Do	719	8 58 0	1 41 3.2	
		Do	10	7 20 25		
		Do	2492	8 42 42	1 22 17	
		Do	10	7 18 50		
		Do	1070	8 5 7.9	0 46 17.9	
Jan. 28	108	Bill Williams's Fork	10	6 31 30		+ 3 6 47.53
		Do	2475	3 49 28.1	2 42 1.9	
		Do	10	7 34 29.8		
		Do	719	8 15 30	0 40 0.2	
		Do	10	6 31 30		
		Do	2492	7 53 50	1 22 20	
		Do	10	6 33 10		
		Do	1070	7 15 32.5	0 42 22.5	
Jan. 30	109	White Cliff creek	10	8 11 40		+ 3 7 22.99
		Do	2475	5 29 25	2 42 15	
		Do	10	8 13 15		
		Do	719	9 54 11.2	1 40 56.2	
		Do	10	8 11 40		
		Do	2492	9 34 9.2	1 22 29.2	
		Do	10	8 13 15		
		Do	1070	8 47 12.3	0 33 57.3	
Jan. 31	110	Cactus Pass	10	8 9 40		+ 3 8 5.64
		Do	2475	5 27 11	2 42 29	
		Do	10	8 9 40		
		Do	719	9 50 59.6	1 41 19.6	
		Do	10	8 8 0		
		Do	2492	9 30 30.1	1 22 30.1	
		Do	10	8 8 0		
		Do	1070	8 37 45	0 29 45	
Feb. 1	111	White Cliff creek	10	9 15 20		+ 3 8 21.9
		Do	2475	6 32 40.9	2 42 39.1	
		Do	10	9 17 10		
		Do	719	10 58 11.6	1 41 1.6	
		Do	10	9 15 20		
		Do	2492	10 37 53	1 22 33	
		Do	10	9 17 10		
		Do	1070	9 42 36	0 25 26	
Feb. 2	111	White Cliff creek	10	8 40 20		+ 3 8 29.1
		Do	2475	5 57 35	2 42 45	
		Do	10	8 41 50		
		Do	719	10 22 46.8	1 40 56.8	
		Do	10	8 39 20		
		Do	2492	10 1 53.5	1 22 33.5	
		Do	10	8 40 20		
		Do	1070	9 1 44	0 21 24	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
				h. m. s.	*h. m. s.*	*h. m. s.*
1854.						
Feb. 4	112	Big Horn springs	10	6 45 05		+ 3 9 8.21
		Do	2475	4 2 1	2 43 4	
		Do	10	6 46 50		
		Do	719	8 27 37.7	1 40 47.7	
		Do	10	6 45 5		
		Do	2492	8 7 41.2	1 22 36.2	
		Do	10	6 49 35		
		Do	1070	7 3 3	0 23 28	
Feb. 6	113	Bill Williams's Fork	10	8 3 40		+ 3 9 18.40
		Do	2475	5 20 12.2	2 43 27.8	
		Do	10	8 3 40		
		Do	719	9 44 12.8	1 40 32.8	
		Do	10	8 2 15		
		Do	2492	9 24 48	1 22 33	
		Do	10	8 2 15		
		Do	1070	8 7 6.1	0 4 51.1	
Feb. 7	115	Bill Williams's Fork	10	9 12 0		+ 3 9 21.33
		Do	2475	6 28 24.5	2 43 35.5	
		Do	10	9 12 0		
		Do	719	10 52 30.9	1 40 30.9	
		Do	10	9 10 25		
		Do	2492	10 32 57.2	1 22 32.2	
		Do	10	9 10 25		
		Do	1070	9 10 52.8	0 0 27.8	
Feb. 8	116	Bill Williams's Fork	10	10 17 15		+ 3 9 34.83
		Do	2475	7 33 20	2 43 55	
		Do	10	10 14 10		
		Do	2492	11 36 36.1	1 22 26.1	
		Do	10	10 15 30		
		Do	1070	10 11 29.8	0 4 10.2	
Feb. 9	117	Bill Williams's Fork	10	10 58 25		+ 3 9 33.10
		Do	2475	8 14 18.5	2 44 6.5	
		Do	10	10 54 40		
		Do	2492	12 17 3.9	1 22 23.9	
		Do	10	10 56 45.1		
		Do	1070	10 48 26.1	0 8 18.9	
Feb. 13	121	Bill Williams's Fork	10	9 28 55		+ 3 10 22.47
		Do	2475	6 44 5.5	2 44 49.5	
		Do	10	9 26 55		
		Do	2492	10 49 18.8	1 22 23.8	
		Do	10	9 28 10		
		Do	1070	9 3 28.1	0 24 41.9	
Feb. 14	121	Bill Williams's Fork	10	7 59 40		
		Do	2475	5 13 34.2	2 45 6.8	
		Do	10	7 57 40		
		Do	2492	9 19 58.4	1 22 18.4	
		Do	10	7 58 45		
		Do	1070	7 30 6.9	0 28 38.1	
Feb. 15	122	Bill Williams's Fork	10	10 21 10		+ 3 11 19.56
		Do	2475	7 35 51.7	2 45 18.3	
		Do	10	10 19 10		
		Do	2492	11 41 23.4	1 22 13.4	
		Do	10	10 20 10		
		Do	1070	9 46 51.9	0 33 18.1	
Feb. 18	125	Bill Williams's Fork	10	8 42 50		+ 3 12 56.64
		Do	2475	5 56 47	2 46 3	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1854.				*h. m. s.*	*h. m. s.*	*h. m. s.*
Feb. 18	125	Bill Williams's Fork	10	8 41 10		
		Do	2492	10 3 8	1 21 58	
		Do	10	8 41 10		
		Do	1070	7 55 34	0 45 36	
Feb. 19	126	Bill Williams's Fork	10	8 38 0		+ 3 13 35.19
		Do	2475	5 51 37	2 46 23	
		Do	10	8 38 0		
		Do	2492	9 59 52.5	1 21 52.5	
		Do	10	8 39 50		
		Do	1070	7 50 1.5	0 49 48.5	
Feb. 20	127	Colorado river	10	9 45 50		+ 3 14 13.36
		Do	2475	6 59 10.5	2 46 39.5	
		Do	10	9 44 20		
		Do	2492	11 6 4.8	1 21 44.8	
		Do	10	9 44 20		
		Do	1070	8 50 6.5	0 54 13.5	
Feb. 21	128	Colorado river	10	9 20 15		+ 3 14 46.63
		Do	2475	6 33 17	2 46 58	
		Do	10	9 18 40		
		Do	2492	10 40 20	1 21 40	
		Do	10	9 18 40		
		Do	1070	8 20 19.5	0 58 25	
Feb. 22	129	Colorado river	10	9 30 30		
		Do	2475	6 43 17.5	2 57 12.5	
		Do	10	9 29 15		
		Do	2492	10 50 45.9	1 21 30.9	
		Do	10	9 31 40		
		Do	1070	8 29 1.1	1 2 38.9	
Feb. 23	130	Colorado river	10	9 17 15		+ 3 15 53.60
		Do	2475	6 29 48.5	2 47 26.5	
		Do	10	9 14 50		
		Do	2492	10 36 19.5	1 21 29.5	
		Do	10	9 16 10		
		Do	1070	8 9 23	1 6 47	
Feb. 24	131	Colorado river	10	10 13 15		+ 3 16 23.94
		Do	2475	7 25 35.2	2 47 39.8	
		Do	10	10 12 0		
		Do	2492	11 33 20.4	1 21 20.4	
		Do	10	10 14 55		
		Do	1070	9 3 46.1	1 11 8.9	
Feb. 25	132	Colorado river	10	9 2 10		+ 3 16 33.51
		Do	2475	6 14 12.5	2 47 57.5	
		Do	10	9 2 10		
		Do	2492	10 23 25	1 21 15	
		Do	10	9 3 30		
		Do	1070	7 48 19.5	1 15 10.5	
Feb. 26	133	Colorado river	10	11 1 35		+ 3 17 16.90
		Do	2475	8 13 20.6	2 48 14.4	
		Do	10	11 5 25		
		Do	2492	12 26 31.9	1 21 6.9	
		Do	10	11 3 40		
		Do	1070	9 43 51.5	1 19 48.5	
March 1	135	Colorado river	10	9 13 45		+ 3 17 55.17
		Do	2475	6 24 40.4	2 49 4.6	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
1854.				*h. m. s.*	*h. m. s.*	*h. m. s.*
March 1	135	Colorado river	10	9 11 50		
		Do	2492	10 32 46.5	1 20 56.5	
		Do	10	9 12 45		
		Do	1070	7 40 33.1	1 32 11.9	
March 2	136	Prairie Camp	10	9 56 50		+ 3 19 17.3
		Do	2475	7 7 28.1	2 49 21.9	
		Do	10	9 54 20		
		Do	2492	11 15 11	1 20 51	
		Do	10	9 55 30		
		Do	1070	8 18 55.7	1 36 46.3	
March 3	137	Pai-ute creek	10	9 25 55		+ 3 19 53.8
		Do	2475	6 36 25.5	2 49 29.5	
		Do	10	9 23 55		
		Do	2492	10 44 45.4	1 20 50.4	
		Do	10	9 24 55		
		Do	1070	7 44 8.5	1 41 46.5	
March 6	140	Near Marl spring	10	10 0 5		+ 3 22 55.30
		Do	2475	7 10 6	2 49 59	
		Do	10	9 58 45		
		Do	2492	11 19 31.1	1 20 46.1	
		Do	10	10 1 35		
		Do	1070	8 8 17	1 53 18	
March 8	142	Soda lake	10	9 38 25		+ 3 25 5.51
		Do	2475	6 48 0.8	2 50 24.2	
		Do	10	9 35 30		
		Do	2492	10 56 14.5	1 20 44.5	
		Do	10	9 37 0		
		Do	1070	7 35 23.6	2 1 36.4	
March 9	143	Mojave river	10	11 46 45		+ 3 26 6.24
		Do	2475	8 56 4.6	2 50 40.4	
		Do	10	11 45 10		
		Do	2492	13 5 51.1	1 20 41.1	
		Do	10	11 43 40		
		Do	1070	9 37 28.6	2 6 11.4	
March 12	145	Mojave river	10	13 9 25		+ 3 28 12.15
		Do	2475	10 18 0	2 51 25	
		Do	10	13 6 10		
		Do	2492	14 26 35.7	1 20 25.7	
		Do	10	13 7 40		
		Do	1070	10 48 44.5	2 18 55.5	
March 13	146	Mojave river	10	12 7 10		+ 3 29 41.94
		Do	2475	9 15 28	2 51 42	
		Do	10	12 4 55		
		Do	2492	13 25 13.2	1 20 18.2	
		Do	10	12 6 0		
		Do	1070	9 42 59.5	2 23 0.5	
March 14	147	Mojave river	10	12 39 20		+ 3 31 14.33
		Do	2475	9 47 19.9	2 52 0.1	
		Do	10	12 37 5		
		Do	2492	13 57 21	1 20 16	
		Do	10	12 38 10		
		Do	1070	10 10 52.4	2 27 27.6	
March 15	148	Near Cajon Pass	10	11 37 10		+ 3 31 52.83
		Do	2475	8 34 55.4	3 2 14.6	

APPENDIX C—Continued.

Date.	Number of camp.	Station.	Number of chronometer.	Reading of chronometer.	Difference.	Chron. fast or slow of sidereal time.
				h. *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
1854.						
March 15	148	Near Cajon Pass	10	11 31 0		
		Do	2492	12 51 15.5	1 20 15.5	
		Do	10	11 38 20		
		Do	1070	8 56 56	2 41 24	
March 19	150	Coco Mango creek	10	11 17 35		+ 3 33 27.89
		Do	2475	8 24 18	2 53 17	
		Do	10	11 15 45		
		Do	2492	12 35 45.9	1 20 0.9	
		Do	10	11 16 35		
		Do	1070	8 28 22.6	2 48 12.4	
March 21	152	Los Angeles	10	12 13 45		+ 3 36 15.31
		Do	2475	9 19 56.9	2 53 48.1	
		1½ mile east of Los Angeles	10	12 12 15		
		Do	2492	13 32 14	1 19 59	
		Do	10	12 13 0		
		Do	1070	9 16 12.9	2 56 47.1	
March 22	152	1½ mile east of Los Angeles	10	12 12 15		+ 3 36 26.20
		Do	2475	9 18 2.9	2 54 2.1	
		Do	10	12 9 55		
		Do	2492	13 29 40.6	1 19 45.6	
		Do	10	12 4 40		
		Do	1070	9 3 34.2	3 1 5.8	

APPENDIX D.

LIST OF CAMPS, WITH DISTANCES, ALTITUDES, ASTRONOMICAL POSITIONS, ETC.

Table containing the Astronomical Positions of each camp between Fort Smith and the Pacific Ocean.

Camp.	Name of station.	Dist. from— Preceding station.	Dist. from— Ft. Smith.	Altitude above the sea.	Latitude.	Longitude. In time.	Longitude. In arc.	Remarks.
		Miles.	*Miles.*	*Feet.*	° ′ ″	*h. m. s.*	° ′ ″	
0	Fort Smith (Camp Wilson).	------	------	466.4	*a* 35 22 55.44	*c* 6 17 56	94 29 0	From Fort Smith to camp 20, on Topofki creek, the country is well wooded and watered. The soil is fertile; grass plenty; and it is scarcely possible to travel a mile without finding a good camp-ground.
1	Ring's Plantation	9.72	9.72	493.1	*a* 35 16 23.82	*a* 6 18 19.01	94 34 45.15	
2	Scullyville	3.96	13.68	539.5	*a* 35 15 1.48	*a* 6 18 34.11	94 38 31.65	
3	Camp creek	8.85	22.53	568	*a* 35 12 45	*a* 6 19 10.76	94 47 41.40	
4	Câche creek	5.10	27.63	552.5	*a* 35 12 42.91	*a* 6 19 32.13	94 53 1.90	
5	Branch of San Bois creek.	5.40	33.03	653.5	*e* 35 10 58	*e* 6 19 52.40	94 58 6	
6	Coon creek	6.60	39.63	583.7	*a* 35 9 41.80	*a* 6 20 19.97	95 4 59.50	
7	First camp on Sans Bois.	9.72	49.35	551.9	*a* 35 7 28.12	*a* 6 20 59.44	95 14 51.60	
8	Sec'd camp on Sans Bois.	7.20	56.55	648.4	*a* 35 5 25.70	*a* 6 21 28.32	95 22 4.80	
9	Santa Rita creek	7.50	64.05	680.3	*a* 35 6 50.30	*a* 6 21 59.77	95 29 56.50	
10	La Honda	15	79.05	632.3	*a* 35 1 32.82	*e* 6 22 58.40	95 44 36	
11	Gaines's creek	3.90	82.95	678.2	*a* 35 1 19.20	*a* 6 23 13.47	95 48 22.50	
12	Coal creek	9.30	92.25	654.5	*e* 35 0 52	*e* 6 23 52.66	95 58 10	
13	Br. of Coal creek	6.36	98.61	692.7	*a* 35 0 0	*a* 6 24 18.91	96 4 43.60	
14	Head of Coal creek	9	107.61	833.2	*a* 34 55 50.20	*a* 6 24 49.91	96 12 28.60	
15	Shawnee Village	9	116.61	812.1	*a* 34 56 10.64	*a* 6 25 28.18	96 22 2.70	
16	Shawnee Town	8.16	124.77	826.3	*a* 34 55 48.40	*a* 6 26 2.90	96 30 43.50	
17	Br. of Boggy river	9.30	134.07	838.6	*a* 34 50 2.92	*a* 6 26 29.88	96 37 28.20	
18	Head of Boggy river	12.24	146.31	917.3	*a* 34 45 41	*a* 6 27 17.66	96 43 32.45	
19	Br. of Topofki creek	7.95	154.26	1088.3	*a* 34 44 27.80	*a* 6 27 50.48	96 57 37.20	
20	Topofki creek	9.90	164.16	1151.8	*a* 34 45 59	*a* 6 28 31.66	97 7 54.90	
21	Beaversville	12.60	176.76	1083.1	*a* 34 53 20.20	*a* 6 29 9.21	97 17 18.15	Wood and grass plenty; water in pools.
22	Little creek.	16.95	193.71	1199.2	*a* 34 56 15.90	*e* 6 30 18	97 34 30	Wood, water, and grass.
23	Br. of Walnut creek	8.70	202.41	1223.1	*a* 35 0 12.30	*a* 6 30 48.63	97 42 9.45	Wood, water, & grass abund't.
24	First camp on Walnut creek.	4.68	207.09	1136.9	*e* 35 4 12	*e* 6 30 53.80	97 43 27	Do.
25	Sec'd camp on Walnut creek.	10.80	217.89	1440.3	*a* 35 5 51.50	*a* 6 31 33.83	97 53 27.45	Do.
26	Branch creek	16.98	234.87	1402.2	*e* 35 16 6	*e* 6 32 26.53	98 6 38	Wood, water, and grass.
27	Deer creek	13.80	248.67	1392	*a* 35 19 53.80	*a* 6 33 20.26	98 20 4	Excellent water; timber and grass abundant.
28	Deer Creek spring	10.20	258.87	1691.8	*a* 35 26 10.10	*a* 6 33 46.80	98 26 42	Water, wood, and grass sufficient for camping purposes.
29	Natural Mound c'k.	18.45	277.32	1735.5	*a* 35 28 5.90	*a* 6 35 4.20	98 46 3	Do.

* The distances given in this column, being obtained by measurement in straight lines from camp to camp, do not include any of the minor sinuosities of the trail.

APPENDIX D—Continued.

Camp.	Name of station.	Dist. from— Preceding station.	Dist. from— Ft. Smith.	Altitude above the sea.	Latitude.	Longitude. In time.	Longitude. In arc.	Remarks.
		Miles.	*Miles.*	*Feet.*	° ′ ″	*h.* *m.* *s.*	° ′ ″	
30	Gypsum creek	14.58	291.90	1710.9	*a* 35 31 40.80	*a* 6 36 4	99 1 0	Water slightly brackish; excellent camp ground one mile below.
31	Comet creek	13.20	305.10	1614	*a* 35 32 21.40	*a* 6 36 58.70	99 14 40.50	Water, grass, & wood abund't.
32	Silver creek	10.44	315.54	1802.7	*a* 35 37 50.60	*a* 6 37 33.90	99 23 28.50	Do.
33	Oak creek	13.08	328.62	1748.3	*a* 35 42 32.60	*a* 6 38 24.70	99 36 10.50	Oak timber, cotton-wood; water and grass abund't.
34	Epsom spring	14.10	342.72	2171.4	*a* 35 48 14	*a* 6 39 16.70	99 49 10.50	Water brackish; grass and wood sufficient for camping purposes.
35	Sweet Water run	12	354.72	2214.8	*a* 35 53 14.10	*a* 6 39 58.70	99 59 40.50	Good water, grass, and firewood; one and a half mile to the Canadian.
36	Canadian river	17.70	372.42	2162.6	*a* 35 50 47.50	*a* 6 41 11.54	100 17 53.10	Abundance of wood, water, and grass.
37	Mouth of Wolf creek	12.60	385.02	2319.1	*a* 35 53 7.60	*a* 6 42 3.44	100 30 51.60	Do.
38	Mt'h of Wine creek.	17.85	402.87	2454.4	*a* 35 58 10.50	*a* 6 43 13.32	100 48 19.80	Wood, water & excell't grass.
39	M'th of Valley river	11.38	414.25	2505.5	*a* 35 57 48.90	*e* 6 43 59.33	100 59 50	Timber, water, and grass, good and abundant.
40	Near m'th of Spring creek.	13.26	427.51	2677.8	*a* 35 54 32.40	*e* 6 44 48	101 12 0	Wood, water, and grass.
41	Last camp on Canadian.	19.70	447.21	2846.9	*a* 35 45 48.40	*a* 6 45 56.12	101 29 1.80	Good water; moderate supply of wood and grass.
42	White Sandy creek	16.29	463.50	3184.1	*a* 35 37 12.70	*a* 6 46 46.32	101 41 34.80	Good water in pools; grass, and enough wood for camp purposes.
43	Shady creek	18.90	482.40	3264.6	*a* 35 25 43.80	*a* 6 47 30.02	101 52 30.30	Abundance of wood, water, and grass.
44	Beautiful View creek	15.96	498 36	3404.7	*a* 35 21 58.40	*a* 6 48 34.92	102 8 43.80	Water in pools; wood scarce; grass abundant.
45	Rincon de la Cruz	16.86	515.22	3777.9	*a* 35 19 50.90	*a* 6 49 45.32	102 26 19.80	Permanent springs; wood and grass.
46	Rocky Dell creek	24.60	539.82	3931.8	*a* 35 17 18.70	*a* 6 51 33.62	102 53 24.30	Abundance of good water, wood, and grass.
47	Cañada de Truxillo	20.10	559.92	3938	*a* 35 6 15.80	*a* 6 52 39.33	103 9 50	Pools of water; tolerable grass; wood scarce.
48	Branch Tucumcari creek.	22.20	582.12	4125.2	*e* 35 1 27	*e* 6 54 8.53	103 32 8	Abundance of water, wood, and grass, at an arroyo near camp.
49	Tucumcari creek	19.20	601.32	4262.4	*a* 35 1 16.10	*a* 6 55 29.93	103 52 29	Excellent camp; wood, water, and grass abundant.
50	Laguna Colorado	18.60	619.92	4587.5	*a* 35 3 2.60	*a* 6 56 47.63	104 11 54.45	Muddy water in pools; wood scarce; grass sufficient.
51	Arroyo Cuerbito	18.68	638.60	4848.4	*a* 35 1 41.30	*a* 6 58 5.73	104 31 26	Brackish water; wood scarce; grass tolerable.
52	Hurrah creek	12	650.60	5047	*a* 35 5 23.70	*a* 6 58 53.82	104 43 27.30	Excellent water and grass; no wood.
53	Sheep spring	21	671	5463.6	*e* 35 14 40.70	*e* 7 0 23.25	105 5 48.76	Perm'nt springs; good grass; wood near by
54	Anton Chico	6	677.60	5372.8	*a* 35 11 10.50	*a* 7 0 39.02	105 9 45.30	Abundance of grass and water; wood in the vicinity.
55	Cañon Blanco	20.40	698	6320	*e* 35 14 5.90	*e* 7 2 6.22	105 31 33.30	Water scarce; timber & wood abundant; grass tolerable.
56	Laguna Blanco	15	713	6796.3	*e* 35 12 16.60	*e* 7 3 7.19	105 46 47.80	Abundance of water & grass; large thickets a mile dist.
57	San Pedro Pass	18	731	6251.1	*e* 35 15 21.20	*e* 7 4 17.03	106 4 15.40	Pools of water; timber abundant; grass good.
58	San Antonio	21.60	752.60	6408.8	*e* 35 6 51.40	*e* 7 5 25.03	106 21 15.40	Abundance of wood, water, and grass.
59	Albuquerque	16.50	769.10	5026.1	*a* 35 5 50.80	*b* 7 6 31.47	106 37 52.05	Abundance of water & grass; no wood.
60	Atrisco	1.80	770.90	5033.1	*e* 35 4 56	*e* 7 6 33.49	106 38 22.85	Do.
61	Isleta	12.30	783.20	4909.6	*a* 34 54 27.06	*a* 7 6 39.92	106 39 58.80	Abundance of water, little grass, and no wood.

APPENDIX D—Continued.

Camp.	Name of station.	Dist. from— Preceding station.	Dist. from— Ft Smith.	Altitude above the sea.	Latitude.	Longitude. In time.	Longitude. In arc.	Remarks.
		Miles.	*Miles.*	*Feet.*	° ′ ″	*h. m. s.*	° ′ ″	
62	Rio Puerco	20.40	803.60	5222.3	*a* 34 55 33.83	*a* 7 7 45.87	106 56 28.05	Small pools of water; grass and wood scarce.
63	Rio San José, (near ruins of Rita.)	18.69	822.20	5556.3	*a* 35 1 9.91	*a* 7 8 57.18	107 14 17.70	Abundance of wood, water, and grass.
64	Covero	12.90	835.10	5879.8	*a* 35 5 22.10	*a* 7 9 44.95	107 26 14.25	Good grass and water; wood not far distant.
65	Hay camp.	13.20	848.30	6080.9	*a* 35 4 59.69	*a* 7 10 36.82	107 39 12.30	Excellent water; plenty of wood and grass.
66	Sierra Madre	16.50	864.80	7031.1	*a* 34 57 17.55	*a* 7 11 30.06	107 52 30.90	No water; wood and grass abundant.
67	Agua Fria	7.50	872.30	7757.1	*a* 35 1 35.56	*a* 7 11 52.99	107 58 14.85	Pine forest; water and grass abundant.
68	Inscription rock, (El Moro.)	15.30	887.60	7237.8	*a* 35 2 40.86	*a* 7 12 57.21	108 14 18.15	Small spring; wood scarce; grass abundant.
69	Ojo del Pescado	14.10	901.70	6551.5	*a* 35 7 4.49	*a* 7 13 51.61	108 27 54.15	Excellent water and grass; sufficient wood for camp purposes.
70	Zuñi river	10.80	912.50	6336.5	*a* 35 3 41.88	*a* 7 14 35.56	108 38 53.40	Do.
	Zuñi*	4.50	917	6260.3	*e* 35 4 2.76	*e* 7 14 50.93	108 42 43.95	Excellent water and grass; no wood.
71	Arch spring	4.50	921.50	6350.1	*e* 35 5 45.10	*e* 7 15 10.39	108 47 35.85	Small springs, wood, & grass.
72	Cedar forest	10.50	932.	6162.2	*a* 35 1 13.23	*a* 7 15 38.46	108 54 36.90	Wood and grass abundant; no water.
73	Jacob's well	18.90	950.90	5973.4	*a* 35 3 53.49	*a* 7 16 56.38	109 14 5.70	Wood, water, & grass abundant.
74	Navajo spring	6.60	957.50	5655.5	*a* 35 6 19.44	*a* 7 17 20.65	109 20 9.75	Water and grass abundant; no wood.
75	Carriso creek	11.40	968.90	5550.1	*a* 35 6 32.35	*a* 7 18 8.08	109 32 1.20	Water obtained by digging; good grass; wood scarce.
76	Near Lithodendron creek.	11.10	980	5499.9	*a* 35 2 7.83	*a* 7 18 43.26	109 40 48.90	Good water and grass; little wood.
77	Near Rio Puerco of the west.	12	992	5110.6	*a* 34 57 56.58	*a* 7 19 28.82	109 52 12.30	Pools of water; grass good; wood scarce.
78	1st camp on Flax river.	11.40	1003.40	5015.7	*a* 34 53 1.95	*a* 7 20 14.22	110 3 33.30	Wood, water, & grass abundant.
79	2d. ----do	13.20	1016.60	4801.7	*a* 34 58 53.15	*a* 7 21 6.95	110 16 44.25	Do.
80	3d. ----do	8.10	1024.70	4735.8	*a* 34 59 30.19	*a* 7 21 40.60	110 25 9	Do.
81	4th ----do	4.80	1029.50	4760.9	*a* 35 1 21.03	*a* 7 21 58.81	110 29 42.15	Do.
82	5th ----do	.80	1030.30	4752.3	*a* 35 2 55.50	*b* 7 22 1.90	110 30 28.50	Do.
83	6th ----do	4.20	1034.50	4675.2	*a* 35 5 18.26	*e* 7 22 12.09	110 33 1.35	Do.
84	7th ----do	9	1046.50	4618.3	*a* 35 12 2.77	*e* 7 22 29.64	110 37 24.60	Do.
85	8th ----do	16.50	1060	4594.3	*a* 35 18 11.74	*e* 7 23 31.77	110 52 56.55	Do.
86	9th ----do	------	------	4569.5	*e* 35 20 54.12	*e* 7 23 45.30	110 56 19.50	Do.
87	Last ---do	.90	1060.90	4597.1	*a* 35 18 43.78	*e* 7 23 34.47	110 53 37.05	Do.
88	Dry camp.	10.80	1071.70	5284.4	*e* 35 18 3.95	*e* 7 24 19.23	111 4 48.40	No water; wood and grass sufficient.
89	Cosnino caves	15.60	1087.30	6139.1	*a* 35 15 2.87	*e* 7 25 23.15	111 20 47.25	Abundance of water, wood, and grass.
90	Near San Francisco spring.	10.80	1098.10	6665.9	*e* 35 12 41.28	*e* 7 26 6.01	111 31 30.15	Wood and grass abundant; water about three miles beyond.
91	Leroux spring	9	1107.10	7378.4	*a* 35 16 48.77	*e* 7 26 38.18	111 39 32.70	Wood, water, & grass abundant.
92	San Francisco forest	8.10	1115.20	7415	*e* 35 17 45.73	*e* 7 27 11.84	111 47 57.60	Wood and grass abundant; no water.
93	San Francisco prairie	5.90	1121.10	7196.8	*e* 35 17 59.67	*e* 7 27 31.98	111 52 59.70	Do.
94	New Year's spring	9	1130.10	6738.7	*a* 35 17 28.08	*e* 7 28 3.97	112 0 59.55	Wood, water, and grass.
95	Lava creek	8.70	1138.80	6317.7	*e* 35 17 42	*e* 7 28 41.49	112 10 22.35	Do.
96	Cedar creek	9.60	1146	5671.7	*e* 35 20 35.09	*e* 7 29 18.27	112 19 34.05	Wood and grass; no water.
97	1st camp on Partridge creek.	7.50	1155.90	5121.9	*a* 35 18 11.33	*b* 7 29 46.93	112 26 43.95	Wood, water, & grass abundant.
98	2d. ----do	3.30	1159.20	4990	*e* 35 15 55.38	*b* 7 29 55.17	112 28 47.55	Do.

* 6260.3. Observation taken at foot of hill upon which the town stands. Estimated height of hill 50 feet.

APPENDIX D—Continued.

Camp.	Name of station.	Dist. from—		Altitude above the sea.	Latitude.	Longitude.		Remarks.
		Preceding station.	Ft. Smith.			In time.	In arc.	
		Miles.	*Miles.*	*Feet.*	° ′ ″	*h. m. s.*	° ′ ″	
99	Picacho spring	12.00	1171.20	4835.8	*a* 35 9 13.62	*e* 7 30 32.03	112 38 0.45	Pools of water; wood and grass abundant.
100	Val de China, (near Picacho.)	.90	1172.10	4734.4	*a* 35 8 46.96	*e* 7 30 34.99	112 38 44.85	Do.
101	S. W. side of Val de China.	7.50	1179.60	5104.4	*e* 35 03 33.40	*e* 7 30 55.42	112 43 51.30	Abundance of wood & grass; no water.
102	Turkey creek	6.00	1185.60	5513.1	*a* 34 59 12	*e* 7 31 3.96	112 45 59.40	Wood, grass, & water abundant.
103	Pueblo creek	3.30	1188.90	5203.5	*a* 34 56 31	*e* 7 31 4.60	112 46 9	Do.
104	Aztec pass	6.30	1195.20	5688.9	*a* 34 55 41.70	*e* 7 31 30.11	112 52 31.65	Do.
105	1st camp on Williams' river.	6.30	1201.50	5751.7	*a* 34 59 25.55	*e* 7 31 49.95	112 57 29.25	Do.
106	2d ....do	6.70	1208.20	5360.3	*a* 35 2 19.66	*e* 7 32 12.69	113 3 10.35	Water in pools; grass good; wood scarce.
107	3d ....do	9.80	1218.00	4811.8	*a* 35 5 58.90	*e* 7 32 49.98	113 12 29.70	Wood, water, & grass abundant.
108	4th ....do	.40	1218.40	4814.0	*a* 35 6 34.30	*e* 7 32 50.75	113 12 41.25	Do.
109	Head of White Cliff creek.	10.80	1229.20	4784.5	*a* 35 12 26.50	*e* 7 33 25.45	113 21 21.75	Water & grass; wood scarce.
110	Cactus pass	6.90	1236.10	5166.1	*a* 35 13 22.50	*e* 7 33 59.35	113 29 50.25	Water, wood, and grass.
111	White Cliff creek	7.50	1243.60	3526.1	*a* 35 8 7.70	*e* 7 34 4.64	113 31 9.60	Do.
112	Big Horn spring	10.80	1254.40	2783.9	*a* 35 0 51.53	*e* 7 34 24.58	113 36 8.70	Water and wood; little grass.
113	5th camp on Williams' river.	12.30	1266.70	2243.5	*e* 34 50 12.04	*e* 7 34 15.51	113 33 52.65	Do.
114	6th ....do	9.00	1275.70	1944.8	*e* 34 42 42.50	*e* 7 34 5.57	113 31 23.55	Do.
115	7th ....do	4.20	1279.90	1853.4	*e* 34 39 6.48	*b* 7 34 2.80	113 30 42	Do.
116	8th ....do	5.20	1285.10	1656.8	*e* 34 35 36.90	*e* 7 33 51.17	113 27 47.55	Do.
117	9th ....do	3.60	1288.70	1499.4	*a* 34 32 29.60	*e* 7 33 50.30	113 27 34.50	Do.
118	10th ....do	6.00	1294.70	1307.7	*e* 34 27 28.60	*e* 7 33 59.49	113 29 52.35	Do.
119	11th ....do	4.50	1299.20	1228.6	*e* 34 23 57.16	*e* 7 33 47.77	113 23 56.55	Do.
120	12th ....do	6.60	1305.80	1184.5	*e* 34 19 30.09	*e* 7 33 35.83	113 23 57.45	Do.
121	13th ....do	3.90	1309.70	1014.7	*a* 34 16 51.10	*d* 7 33 44.83	113 26 12.45	Do.
122	14th ....do	8.40	1318.10	899.3	*a* 34 12 32.40	*e* 7 34 12.19	113 33 2.85	Do.
123	15th ....do	6.00	1324.10	868.5	*e* 34 13 44.10	*e* 7 34 36.77	113 39 11.55	Do.
124	16th ....do	5.40	1329.50	693.4	*e* 34 14 47.65	*e* 7 34 58.58	113 44 38.70	Do.
125	17th ....do	3.60	1333.10	504.4	*a* 34 15 11.50	*e* 7 35 12.48	113 48 7.20	Do.
126	18th ....do	7.80	1340.90	441.1	*a* 34 17 19.05	*e* 7 35 42.47	113 55 37.05	Do.
	Mouth of Williams' river.	4.80	1345.70	378.3	*a* 34 17 46.58	*e* 7 36 0	114 0 0	Do.
127	1st camp on Colorado river.	4.70	1350.40	398.4	*a* 34 21 43.10	*e* 7 36 7.86	114 1 57.90	Wood, water and grass.
128	2d. ....do	3.70	1354.10	382.4	*a* 34 23 10.10	*e* 7 36 25.66	114 6 24.90	Do.
129	3d. ....do	6.90	1361.00	416.0	*e* 34 27 26.44	*e* 7 36 45.24	114 11 18.60	Water and grass; wood scarce.
130	4th ....do	11.10	1372.10	589.8	*a* 34 36 19.20	*e* 7 37 4.36	114 16 5.40	Do.
131	5th ....do	11.20	1383.30	408.3	*a* 34 44 30	*e* 7 37 28.07	114 22 1.05	Wood and water; grass scarce.
132	6th ....do	1.80	1385.10	431.8	*a* 34 45 53.60	*e* 7 37 31.23	114 22 48.45	Wood, water, and grass.
133	7th ....do	8.40	1393.50	432.9	*a* 34 50 23.20	*e* 7 37 59.45	114 29 51.75	Water; no wood nor grass.
134	8th ....do	.30	1393.80	432.9	*e* 34 50 18.29	*e* 7 38 0.75	114 30 11.25	Wood and water; no grass.
135	Last ....do	3.40	1397.20	430.3	*a* 34 52 15.60	*e* 7 38 6.88	114 31 43.20	Wood, water, and grass abundant.
136	Prairie camp	17.70	1414.90	2173.7	*a* 35 1 21.30	*e* 7 39 9.90	114 47 28.50	Little grass; no wood nor water.
137	Pai-ute creek	8.70	1423.60	2790.7	*a* 35 6 26.10	*e* 7 39 35.06	114 53 45.90	Wood, grass, and water.
138	Yucca grove	13.20	1436.80	4381.8	*e* 35 7 51.85	*e* 7 40 30.10	115 7 31.50	Grass good; no wood nor water.
139	Rock spring	6.90	1443.70	4896.0	*e* 35 9 3.42	*e* 7 40 58.18	115 14 32.70	Wood, water, and grass.
140	Near Marl springs	17.40	1461.10	3792.7	*a* 35 11 8	*e* 7 42 10.30	115 32 34.50	Good grass; wood scarce; water one mile beyond.
141	Sand camp	14.10	1475.20	2038.5	*e* 35 5 36.25	*e* 7 43 3.13	115 45 46.95	Wood and grass scarce; no water.

APPENDIX D—Continued.

Camp.	Name of station.	Dist. from—		Altitude above the sea.	Latitude.	Longitude.		Remarks.
		Preceding station.	Ft. Smith.			In time.	In arc.	
		Miles.	*Miles.*	*Feet.*	° ′ ″	*h. m. s.*	° ′ ″	
142	Soda lake	12.90	1488.10	1001.7	*a* 35 3 13.20	*e* 7 43 55.06	115 58 45.90	Brackish water obtained by digging; salt grass plenty; wood scarce.
143	1st camp on Mojave river.	12.60	1500.70	1216.1	*a* 35 0 34.05	*b* 7 44 46.30	116 11 34.50	Wood and water plenty; grass very scarce.
144	2d ---- do	9.00	1509.70	1659.0	*e* 34 58 13.05	*e* 7 45 21.72	116 20 25.8	Wood, water, and grass in abundance.
145	3d ---- do	9.60	1519.30	1884.7	*a* 34 55 32.10	*e* 7 46 5.31	116 31 19.65	Do.
146	4th ----do	19.20	1538.50	2178.0	*a* 34 53 15.50	*e* 7 47 24.72	116 51 10.80	Do.
147	5th ----do	21.30	1559.80	2473.7	*a* 34 45 55.40	*e* 7 48 46.91	117 11 43.65	Do.
148	N. E. slope of San Bernardino Mts.	22.80	1582.60	3442.6	*a* 34 27 15.30	*e* 7 49 15.83	117 18 57.45	Wood and grass plenty; no water.
149	Cajon creek	14.10	1596.70	2527.5	*e* 34 15 18.19	*e* 7 49 25.42	117 21 21.30	Wood and water plenty; grass tolerable.
150	Coco Mongo creek	14.30	1611.00	1223.5	*a* 34 6 27.40	*e* 7 50 5.11	117 31 16.65	Wood, water, and grass abundant.
151	San Gabriel creek	23.70	1634.70	249.1	*e* 34 4 47.82	*e* 7 51 42.89	117 55 43.35	Do.
152	Near Los Angeles	12.90	1647.60	352.0	*a* 34 3 14.70	*e* 7 52 36.89	118 9 13.35	Little wood; water and grass abundant.
	Los Angeles	1.50	1649.10	✲250.0	*e* 34 3 15	*e* 7 52 42.94	118 10 44.10	
153	San Pedro	23.70	1672.80	†30.0	*f* 33 43 19.59	*f* 7 53 4.20	118 16 3	

✲ Town estimated to be about 100 feet below camp 152.
† Estimated.
a Determined by astronomical observations, with sextant and chronometers.
b Determined by lunar culminations.
c Determined by lunar distances.
d Determined by an occultation of Mars.
e Determined by survey from preceding camp.
f Determined by United States Coast Survey.

APPENDIX E.

MAGNETIC OBSERVATIONS.

The instrument, with which the following observations were made, was constructed by W. George, of Falmouth, England, under the immediate direction of Mr. Fox, for the use of Col. J. D. Graham, of the corps of Topographical Engineers, upon the survey of the N. E. boundary. Afterwards, under the direction of Major W. H. Emory, of the same corps, it was used by me upon the Isthmus of Panama, and in California upon the survey of the Mexican boundary. Before and after this trip, in order to determine the changes which might take place in the condition of the needles, Prof. Bond and myself made several complete sets of observations with this instrument at Harvard College observatory. It was then again transported across the continent upon the boundary survey, observations being taken at Galveston, at Indianola, and at very numerous camps, upon the march, via El Paso, to the Pacific. From San Diego it was taken to San Francisco and Sacramento city, and then carried back to El Paso, verifying upon the way many of the results previously obtained. Those observations I made with great care. They form a portion of the results belonging to the Mexican Boundary survey. When combined with the other material, of a similar character, collected by Major Emory upon the same work, and by Col. Graham upon the N. E. Boundary survey, they will, in connexion with the following, form data for a determination of the magnetic elements over a considerable portion of North America.

This instrument, which I left at El Paso, was loaned by the Hon. Secretary of the Interior for the Pacific Railroad survey, and was placed in charge of Lieut. J. C. Ives, Topographical Engineers, for use upon our route, near the 35th parallel, from Rio Grande to the Pacific. After the performance of this trip it was again, through the kindness of Professor Bond, tested by observations at the Cambridge observatory; thus enabling us to place confidence in the long series of results obtained with it.

For the following field observations I desire to give due credit to Lieut. Ives. Those who understand the persevering industry required in such operations, cannot fail to appreciate the value of his services in this branch of science.

OBSERVATIONS WITH FOX'S MAGNETIC INCLINATION AND INTENSITY INSTRUMENT.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29. 6*s*.
Needle, C. Date, August 9, 1850. *Hour of beginning,* 11*h*. *a. m.; hour of ending,* 11*h*. 15*m*. *a. m.*
Observers, Prof. W. C. Bond and Lieut. A. W. Whipple.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	47	49	
	47	47	
	47	47	
Needle vertical, face of circle south, reading of azimuth circle	47	26	
	47	55	
	47	70	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	47	49	00
Reading of azimuth circle when plane of instrument is in the true meridian	38	18	45
Approximate magnetic declination	9	30	15 W.

OBSERVATIONS FOR MAGNETIC INCLINATION—No. 1.

Face of circle.	With marked end of needle, N. pole.		Thermom. Fahrenh't.	With marked end of needle, S. pole.		Thermom. Fahrenh't.
	North end of needle reads—	South end of needle reads—		North end of needle reads—	South end of needle reads—	
	° ′ ″	° ′ ″	°	° ′ ″	° ′ ″	°
East	74 40	74 55	75	74 28	74 23	75
	74 30	74 35	----------	74 38	74 45	----------
	74 28	74 30	----------	74 40	74 45	----------
West	74 31	74 28	----------	74 32	74 35	----------
	74 33	74 30	----------	74 30	74 35	----------
	74 33	74 28	----------	74 30	74 30	----------
Means	74 32 30	74 34 20	75	74 33 00	74 35 30	75

Mean of four results ..... 74° 33′ 50″

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29. 6*s*.
Date, August 9, 1850. *Hour of beginning,* 10*h*. 25*m*. *a. m.; hour of ending,* 10*h*. 45*m*. *a. m.*

		°	′	″
Reading of azimuth circle when plane of instrument is in the true meridian	Face west	85	10	
		85	14	
	Face east	85	10	
		85	15	
Mean		85	12	15
Needle (C) vertical, face of circle north, reading of azimuth circle by a mean of five observations		93	53	12
Needle (C) vertical, face of circle south, reading of azimuth circle by a mean of five observations		95	31	48
Reading of azimuth circle when plane of instrument is in the magnetic meridian		94	42	30
Reading of azimuth circle when plane of instrument in the true meridian		85	12	15
Approximate magnetic declination		9	30	15 W.

OBSERVATIONS—Continued.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29.6*s*.
Needle, A. Date, August 9, 1850. *Hour of beginning*, 3*h*. 40*m*. *p. m.*; *hour of ending*, 4*h*. 6*m*. *p. m.*
Observers, Prof. W. C. Bond and Lieut. A. W. Whipple.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	47	40	
	47	69	
	47	45	
Needle vertical, face of circle south, reading of azimuth circle	47	70	
	47	70	
	47	67	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	48	00	10
Reading of azimuth circle when plane of instrument is in the true meridian	38	18	45
Approximate magnetic declination	9	41	25 W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	74 30	104 25	44 22	75	110 60	37 15	75
	74 30	104 30	44 25	------	110 60	37 20	------
	74 15	104 15	44 15	------	110 55	37 20	------
West	74 18	104 00	44 20	------	110 58	37 20	------
	74 30	103 55	44 30	------	110 58	37 22	------
	74 15	104 15	44 15	------	110 53	37 25	------
	° ′ ″	° ′ ″			° ′ ″		
Means	74 23 00	(1) 104 13 20		75	(1) 110 57 20		75
		(2) 44 21 10			(2) 37 20 20		
		° ′ ″			° ′ ″		
Difference	------	59 52 10		------	73 37 00		------
		° ′ ″			° ′ ″		
Half difference, or angle of deflection	------	29 56 5		------	36 48 30		------
		° ′ ″			° ′ ″		
Sum of means	------	148 34 30		------	148 17 40		------
		° ′ ″			° ′ ″		
Half sum = dip	------	74 17 15		------	74 8 50		------

OBSERVATIONS—Continued.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29. 6*s*.
Needle, A. Date, August 9, 1850. *Hour of beginning,* 12*h*. 25*m*. *p. m.; hour of ending,* 1*h*. 25*m*. *p. m.*
Observers, Prof. W. C. Bond and Lieut. A. W. Whipple.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	47	40	
	47	69	
	47	45	
Needle vertical, face of circle south, reading of azimuth circle	47	70	
	47	70	
	47	67	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	48	00	10
Reading of azimuth circle when plane of instrument is in the true meridian	38	18	45
Approximate magnetic declination	9	41	25 W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 2.

Face of circle.	Direct.	Def. N. 40° from dip.		Def. S. 40° from dip.		Results.		
		° ′ at 34 23	° ′ at 114 23	° ′ at 34 23	° ′ at 114 23			
	° ′	° ′	° ′	° ′	° ′		° ′ ″	
East	74 30	90 63	57 35	92 37	56 00		74 23 00	Direct.
	74 30	90 65	57 30	92 37	56 02			
	74 15	90 62	57 37	92 35	56 05			
						N.	74 17 10	By deflectors.
						S.	74 16 15	
West	74 18	90 60	57 32	92 28	56 00			
	74 30	90 55	57 35	92 28	56 00			
	74 15	90 55	57 37	92 28	55 55			
	° ′ ″	° ′ ″		° ′ ″		° ′ ″		
Means	74 23 00	91 00 00		92 32 10		74 18 48		Mean.
		57 34 20		56 00 20				
		° ′ ″		° ′ ″				
Sum of means		148 34 20		148 32 30				
		° ′ ″		° ′ ″				
Half sum = dip.		74 17 10		74 16 15			+ 15 04	Corrections. Index error.
		° ′ ″		° ′ ″				
Difference		33 25 40		36 31 50				
		° ′ ″		° ′ ″			° ′ ″	
Half diff. or angle of deflection		16 42 50		18 15 55			74 33 52	True inclination.

OBSERVATIONS—Continued.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29.6*s*.
Needle, A. Date, August 9, 1850. *Hour of beginning,* 4*h*. 15*m*. *p. m.; hour of ending,* 4*h*. 30*m*. *p. m.*
Observers, Prof. W. C. Bond and Lieut. A. W. Whipple.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	47	40	
	47	69	
	47	45	
Needle vertical, face of circle south, reading of azimuth circle	47	70	
	47	70	
	47	67	
Reading of azimuth circle when plane of instrument is in magnetic meridian	48	00	10
Reading of azimuth circle when plane of instrument is in true meridian	38	18	45
Approximate magnetic declination	9	41	25 W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 3.

Face of circle.	Direct.	Def. S. at app. dip. 74° 23′.			Def. N. at app. dip. 74° 23′.		
		Def. towards the vertical.	Def. from the vertical.	Ther. Fahr.	Def. towards vertical.	Def. from the vertical.	Ther. Fahr.
	° ′	° ′	° ′	°	° ′	° ′	°
East	74 30	108 18	40 10	75	105 07	43 35	75
	74 30	108 28	40 10	------	105 05	43 35	------
	74 15	108 15	40 15	------	105 15	43 33	------
West	74 18	108 28	40 17	------	105 00	43 22	------
	74 30	108 28	40 20	------	105 00	43 28	------
	74 15	108 28	40 05	------	104 55	43 23	------
	° ′ ″	° ′ ″			° ′ ″		
Means	74 23 00	108 24 10		------	105 03 40		------
		40 12 50		------	43 29 20		------
		° ′ ″			° ′ ″		
Sum	------	148 37 00		------	148 33 00		------
		° ′ ″			° ′ ″		
Half sum = dip.	------	74 18 30		------	74 16 30		------
		° ′ ″			° ′ ″		
Difference.	------	68 11 20		------	61 34 20		------
		° ′ ″			° ′ ″		
Half difference, or angle of deflection	------	34 05 40		------	30 47 10		------

OBSERVATIONS—Continued.

Station. Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h.* 44*m.* 29.6*s.*
Needle, B. Date, August 9, 1850. *Hour of beginning,* 5*h.* 40*m. p. m.; hour of ending,* 6*h.* 20*m. p. m.*
Observers, Prof. W. C. Bond and Lieut. A. W. Whipple.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	47	00	
	47	29	
	47	07	
Needle vertical, face of circle south, reading of azimuth circle	48	26	
	48	15	
	48	40	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	47	49	30
Reading of azimuth circle when plane of instrument is in the true meridian	38	18	45
Approximate magnetic declination	9	30	45 W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 2.

Face of circle.	Direct.	Def. N. 40° from dip.		Def. S. 40° from dip.		Results.		
		at 34 26	at 114 26	at 34 26	at 114 26			
	° ′	° ′	° ′	° ′	° ′		° ′ ″	
East	74 30	91 30	57 15	92 27	56 15		74 25 50	Direct.
	74 28	91 30	57 10	92 28	56 15			
	74 25	91 30	57 10	92 28	56 15			
						N.	74 18 40	By deflectors.
						S.	74 21 30	
West	74 22	91 25	57 00	92 30	56 25			
	74 30	91 28	57 08	92 25	56 15			
	74 20	91 28	57 10	92 20	56 15			
	° ′ ″	° ′ ″		° ′ ″			° ′ ″	
Means	74 25 50	91 28 30		92 26 20			74 22 00	Mean.
		57 08 50		56 16 40				
		° ′ ″		° ′ ″				
Sum of means		148 37 20		148 43 00				
		° ′ ″		° ′ ″				
Half sum = dip		74 18 40		74 21 30			+ 8 48	Corrections. Index error.
		° ′ ″		° ′ ″				
Difference		34 19 40		36 09 40				
		° ′ ″		° ′ ″			° ′ ″	
Half difference, or angle of deflection		17 09 50		18 04 50			74 30 48	True inclination.

OBSERVATIONS—Continued.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29. 6*s*.
Needle, B. Date, August 9, 1850. *Hour of beginning,* 6*h*. 40*m*. *p. m.; hour of ending,* 6*h*. 50*m*. *p. m.*
Observers, Prof. W. C. Bond and Lieut. A. W. Whipple.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	47	00		
	47	29		
	47	07		
Needle vertical, face of circle south, reading of azimuth circle	48	26		
	48	15		
	48	40		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	47	49	30	
Reading of azimuth circle when plane of instrument is in the true meridian	38	18	45	
Approximate magnetic declination	9	30	45	W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 1½ gr.			Def. with wt. 2½ gr.		
		Def. toward the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. toward the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	74 30	79 55	68 55	75	104 00	44 35	75
	74 28	80 05	68 45	------	104 05	44 17	------
	74 25	80 07	68 45	------	104 05	44 15	------

West	74 22	------	------	------	------	------	------
	74 30	------	------	------	------	------	------
	74 20	------	------	------	------	------	------
	° ′ ″	° ′ ″			° ′ ″		
Means	74 25 50	(1) 80 01 10		75	(1) 104 01 40		------
		(2) 68 24 10			(2) 44 11 10		------
		° ′ ″			° ′ ″		
Differences	------	11 37 00		------	59 50 30		------
		° ′ ″			° ′ ″		
Half differences, or angles of deflection	------	5 48 30		------	29 55 15		------
		° ′ ″			° ′ ″		
Sum of means	------	148 25 20		------	148 12 50		------
		° ′ ″			° ′ ″		
Half sum = dip	------	74 12 40		------	74 6 25		------

OBSERVATIONS—Continued.

Station, Albuquerque, Camp 59 ; *latitude* 35° 5′ 50″; *longitude* 7*h.* 6*m.* 31. 47*s.*
Needle, C. Date, October 17, 1853. *Hour of beginning,* 1*h.* 30*m. p. m.* ; *hour of ending,* 2*h.* 30*m. p. m.*
Observers, Lieut. A. W. Whipple and Lieut. J. C. Ives, Topographical Engineers.

	° ′ ″	° ′ ″
Needle vertical, face of circle north, reading of azimuth circle	38 25	38 49
	38 5	38 40
	38 14	38 20
Needle vertical, face of circle south, reading of azimuth circle	38 23	38 25
	38 51	38 50
	38 45	38 13
Mean	38 27 10	38 32 50
	38 32 50	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38 30 00	
Reading of azimuth circle when plane of instrument is in the true meridian	51 53 14	
Approximate magnetic declination	13 23 14 E.	

OBSERVATIONS FOR MAGNETIC INCLINATION—No. 1.

Face of circle.	With marked end of needle, N. pole.		Thermometer, Fahrenheit.	With marked end of needle, S. pole.		Thermometer, Fahrenheit.
	North end of needle reads—	South end of needle reads—		North end of needle reads—	South end of needle reads—	
	° ′ ″	° ′ ″	°	° ′ ″	° ′ ″	°
East	62 15	62 18	76	62 38	62 33	----------
	62 28	62 30	----------	62 33	62 28	----------
	62 25	62 30	----------	62 25	62 22	72
West	62 30	62 30	----------	62 35	62 35	----------
	62 28	62 28	----------	62 45	62 40	----------
	62 37	62 30	76½	62 37	62 40	----------
Means	62 27 10	62 27 40	----------	62 35 30	62 33 00	----------

Mean of 4 results ..... 62° 30′ 50″

Station, Camp No. 59, *Albuquerque. Date, October* 17, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer, No. 2475.	Read'g of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	3 21 30. 5	52 40	1 00 13	51 39 47
	Direct	----------	----------	----------	----------
East	Direct	3 29 22. 6	53 10	1 03 19	----------
	Direct	----------	----------	----------	52 6 42
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observat'ns					51 53 14

Error of chronometer + 1*m.* 17*s.*

OBSERVATIONS—Continued.

Station, Albuquerque; latitude 35° 05′ 50″; *longitude* 7*h.* 06*m.* 31.47*s.*

Needle, A. Date, October 18, 1853. *Hour of beginning,* 12*h.* 15*m. p. m.; hour of ending,* 1*h.* 30*m. p. m.*

Observers, Lieut. A. W. Whipple and Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	38	51	
	38	21	
	38	55	
Needle vertical, face of circle south, reading of azimuth circle	38	55	
	38	44	
	38	23	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38	41	30
Reading of azimuth circle when plane of instrument is in the true meridian	51	54	51
Approximate magnetic declination	13	13	21

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2.5 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	62 20	87 58	36 50	75.5	94 45	29 50	74.5
	62 25	87 55	36 48	74.5	94 58	29 40	------
	62 13	87 52	36 52	------	94 53	29 38	------
West	62 07	87 32	36 28	75	94 45	29 30	75
	62 05	87 30	36 30	------	94 40	29 40	------
	62 00	87 47	36 25	75	94 23	29 42	75
	° ′ ″	° ′ ″			° ′ ″		
Means	62 11 40	(1) 87 45 40		75	(1) 94 44 00		75
		(2) 36 38 50			(2) 29 40 00		
		° ′ ″			° ′ ″		
Differences	------	51 06 50		------	65 04 00		------
		° ′ ″			° ′ ″		
Half differences, or angles of deflection	------	25 33 25		------	32 32 00		------
		° ′ ″			° ′ ″		
Sum of means	------	124 24 30		------	24 24 00		------
		° ′ ″		------	° ′ ″		
Half sum = dip	------	62 12 15			62 12 00		------

OBSERVATIONS—Continued.

Station, Camp 59, *Albuquerque; latitude* 35° 05′ 50″; *longitude* 7*h.* 6*m.* 31.47*s.*
Needle, A. Date, October 18, 1853. *Hour of beginning,* 1*h.* 50*m. p.m.; hour of ending,* 2*h.* 35*m. p. m.*
Observers, Lieut. A. W. Whipple and Lieut. J. C. Ives, Topographical Engineers.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	38	51		
	38	21		
	38	55		
Needle vertical, face of circle south, reading of azimuth circle	38	55		
	38	44		
	38	23		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38	41	30	
Reading of azimuth circle when plane of instrument is in the true meridian	51	54	51	
Approximate magnetic declination	13	13	21	E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 2.

Face of circle.	Direct.	Def. N. 40° from dip. at 22 12	Def. N. 40° from dip. at 102 12	Def. S 40° from dip. at 22 12	Def. S 40° from dip. at 102 12	Results. Ther. 75°		
	° ′	° ′	° ′	° ′	° ′		° ′ ″	
East	62 20	79 28	44 60	81 18	43 25		62 11 40	Direct.
	62 25	79 35	44 60	81 15	43 20			
	62 13	79 30	44 72	81 05	43 28	N.	62 14 35	By deflectors.
						S.	62 14 30	
West	62 07	79 20	44 58	81 02	43 15			
	62 05	79 28	44 55	81 05	43 22			
	62 00	79 27	44 62	84 07	43 12			
	° ′ ″	° ′ ″		° ′ ″		° ′ ″		
Means	62 11 40	79 28 00		81 08 40		62 13 35		Mean.
		45 01 10		43 20 20				
		° ′ ″		° ′ ″				
Sum of means		124 29 10		124 29 00				
		° ′ ″		° ′ ″				
Half sum of means = dip.		62 14 35		62 14 30		+ 15 04		Corrections. Index error.
		° ′ ″		° ′ ″				
Differences		34 26 50		37 48 20				
		° ′ ″		° ′ ″		° ′ ″		
Angles of deflection		17 13 25		18 54 10		62 28 39		True inclination.

OBSERVATIONS—Continued.

Station, Camp No. 59, *Albuquerque. Date, October* 18, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 2475.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	° ′	′ ″	° ′ ″
West	Direct	1 47 21.2	52 01	18 08	51 43 22
	Direct	1 45 03.5	52 02		
East	Direct	1 35 42.1	52 20	14 10	52 06 20
	Direct	1 39 58.5	52 21		
Reading of azimuth circle when plane of instrument is the true meridian, by mean of four observations					51 54 51

Error of chronometer + 1*m.* 29*s.*

Station, Camp 59, *Albuquerque; latitude* 35° 5′ 50″; *longitude* 7*h.* 6*m.* 31. 47*s.*

Needle, A. Date, October 19, 1853. *Hour of beginning,* 10 *a. m.; hour of ending,* 11 *a. m.*

Observers, Lieut. A. W. Whipple and Lieut. J. C. Ives, Topographical Engineers.

	° ′ ″
Needle vertical, face of circle north, reading of azimuth circle	38 39
	38 25
	38 10
Needle vertical, face of circle south, reading of azimuth circle	38 24
	38 33
	38 51
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38 30 20
Reading of azimuth circle when plane of instrument is in the true meridian	51 54 51
Approximate magnetic declination	13 24 31 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 3.

Face of circle.	Direct.	Def. S. at app. dip. 62° 9′.			Def. N. at app. dip. 62° 9′.		
		Def. towards the vertical.	Def. from the vertical.	Ther. Fahr.	Def. towards the vertical.	Def. from the vertical.	Ther. Fahr.
	° ′	° ′ ″	° ′ ″	°	° ′ ″	° ′ ″	°
East	62 20	96 60	27 17	74	93 25	30 62	73
	62 15	96 62	27 15	-------	93 29	30 47	-------
	62 10	96 55	27 18	-------	93 37	30 45	-------
West	62 7	96 65	27 10	72	93 15	30 53	73
	62 2	96 57	27 13	-------	93 18	30 58	-------
	62 0	96 61	27 25	-------	93 23	30 45	-------
Means	62 9	97 0	27 16 20	73	93 24 30	30 51 40	73
		27 16 20	----------	-------	30 51 40	----------	-------
Sum of means	----------	124 16 20	----------	-------	124 16 10	----------	-------
Half sum = dip	----------	62 8 10	----------	-------	62 8 5	----------	-------
Difference of means	----------	69 43 40	----------	-------	62 32 50	----------	-------
Half dif. = angle of deflection	----------	34 51 50	----------	-------	31 16 25	----------	-------

OBSERVATIONS—Continued.

Station, Camp 59, *Albuquerque; latitude* 35° 5′ 50″; *longitude* 7*h.* 6*m.* 31.47*s.*

Needle, C. Date, October 20, 1853. *Hour of beginning,* 4*h.* 30*m. p. m.; hour of ending,* 5*h.* 15*m. p. m.*

Observers, Lieut. A. W. Whipple and Lieut. J. C. Ives, Topographical Engineers.

	Marked end S. P.			Marked end N. P.		
	°	′	″	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	38	57		38	33	
	38	27		38	02	
	38	47		38	30	
Needle vertical, face of circle south, reading of azimuth circle	38	19		38	67	
	37	49		38	17	
	38	15		38	44	
	38	25	40	38	32	10
				38	25	40

	°	′	″	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38	28	55	
Reading of azimuth circle when plane of instrument is in the true meridian	51	54	51	
Approximate magnetic declination	13	25	56	E.

OBSERVATIONS FOR MAGNETIC INCLINATION—No. 1.

Face of circle.	With marked end of needle, N. pole.		Thermometer, Fahrenheit.	With marked end of needle, S. pole.		Thermometer, Fahrenheit.
	North end of needle reads—	South end of needle reads—		North end of needle reads—	South end of needle reads—	
	° ′ ″	° ′ ″	°	° ′ ″	° ′ ″	°
West.	62 25	62 21	76	62 30	62 30	76
	62 28	62 32	----------	62 28	62 21	----------
	62 27	62 25	----------	62 43	62 40	----------
East	62 25	62 28	72	62 25	62 28	72
	62 33	62 36	----------	62 13	62 15	----------
	62 18	62 20	----------	62 13	62 10	----------
Means	62 26	62 27	74	62 25 20	62 24	74

Mean of 4 results ---------- 62° 25′ 35″.

OBSERVATIONS—Continued.

Station, Camp 59, *Albuquerque; latitude* 35° 5′ 50″; *longitude* 7*h.* 6*m.* 31.47*s.*
Needle, B. Date, October 21, 1853. *Hour of beginning,* 11*h.* 30*m. a. m.; hour of ending,* 12*h.* 30*m. p. m.*
Observers, Lieut. A. W. Whipple and Lieut. J. C. Ives, Topographical Engineers.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	38	16		
	38	22		
	38	16		
Needle vertical, face of circle south, reading of azimuth circle	38	35		
	38	52		
	38	52		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38	32	10	
Reading of azimuth circle when plane of instrument is in the true meridian	51	54	51	
Approximate magnetic declination	13	22	41	E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	62 22	87 62	36 22	72	102 17	21 32	73
	62 20	87 58	36 2	------	102 27	21 23	------
	62 28	87 65	36 15	------	102 25	21 20	------
West	62 10	87 55	36 15	------	102 28	21 50	------
	62 25	87 65	36 25	------	102 20	21 48	------
	62 17	87 47	36 30	74	102 18	21 51	75
	° ′ ″	° ′ ″			° ′ ″		
Means	62 20 20	(1) 87 58 40		73	(1) 102 22 30		74
		(2) 36 18 30			(2) 21 37 20		
		° ′ ″			° ′ ″		
Differences	------	51 40 10		------	80 45 10		------
		° ′ ′			° ′ ″		
Half diff. or angles of deflection	------	25 50 5		------	40 22 35		------
		° ′ ″			° ′ ″		
Sum of means	------	124 17 10		------	123 59 50		------
		° ′ ″			° ′ ″		
Half sum = dip	------	62 8 35		------	61 59 55		------

OBSERVATIONS—Continued.

Station, Camp 59, Albuquerque; latitude 35° 05′ 50″; longitude 7h. 6m. 31.47s.
Needle, B. Date, October 21, 1853. Hour of beginning, 12h. 30m. p. m.; hour of ending, 1h. 15m. p. m.
Observers, Lieut. A. W. Whipple and Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	38	16	
	38	22	
	38	16	
Needle vertical, face of circle south, reading of azimuth circle	38	35	
	38	52	
	38	52	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38	32	10
Reading of azimuth circle when plane of instrument is in the true meridian	51	54	51
Approximate magnetic declination	13	22	41 E.

OBSERVATIONS FOR MAGNETIC INCLINATION—No. 2.

Face of circle.	Direct.	Def. N. 40° from dip.		Def. S. 40° from dip.		Results.		
		° ′ at 22 20	° ′ at 102 20	° ′ at 22 20	° ′ at 102 20			
East	° ′ 62 22	° ′ 79 60	° ′ 44 35	° ′ 80 60	° ′ 43 35		° ′ ″ 62 20 10	Direct.
	62 20	79 60	44 37	80 68	43 30			
	62 28	79 58	44 40	80 62	43 33	N.	62 16 40	By deflectors.
						S.	62 17 40	
West	62 10	79 45	44 35	80 57	43 32			
	62 25	79 50	44 40	80 60	43 37			
	62 17	79 52	44 48	80 58	43 40			
Means	° ′ ″ 62 20 20	° ′ ″ 79 54 10		° ′ ″ 81 00 50			° ′ ″ 62 18 10	Mean.
		44 39 10		43 34 30				
Sum of means		° ′ ″ 124 33 20		° ′ ″ 124 35 20				
Half sum = dip		° ′ ″ 62 16 40		° ′ ′ 62 17 40			+ 8 48	Corrections. Index error.
Differences		° ′ ″ 35 15 50		° ′ ″ 37 17 40				
Half differences, or angles of deflection		° ′ ″ 17 37 30		° ′ ″ 18 43 10			° ′ ″ 62 26 58	True inclination.

OBSERVATIONS—Continued.

Station, Camp 61, *Isleta; latitude* 34° 54′ 27″. 06; *longitude* 7*h*. 06*m*. 40*s*.
Needle, B. Date, November 9, 1853. *Hour of beginning,* 4*h*. *p. m.; hour of ending,* 5*h*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	46	44	
	46	47	
	46	51	
Needle vertical, face of circle south, reading of azimuth circle	46	24	
	46	55	
	46	46	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	46	44	30
Reading of azimuth circle when plane of instrument is in the true meridian	59	57	55
Approximate magnetic declination	13	13	25 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 1 gr.			Def. with wt. 2 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	62 12						
	62 15						
	62 08						
West	62 18	49 35	74 50		36 35	87 75	
	62 21	49 38	74 55		36 32	87 50	
	62 20	49 37	74 58	55	36 28	88 08	53
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	62 15 40	(1) 49 36 40		55	(1) 36 31 40		53
		(2) 74 54 20			(2) 88 04 20		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	62 24 28						
Differences		° ′ ″			° ′ ″		
		25 17 40			51 32 40		
Half diff. or angles of deflection		° ′ ″			° ′ ″		
		12 38 50			25 46 20		
Sum of means		° ′ ″			° ′ ″		
		124 31 00			124 36 00		
Half sum = dip		° ′ ″			° ′ ″		
		62 15 30			62 18 00		

OBSERVATIONS—Continued.

Station, Camp No. 61, *Isleta. Date, November* 9, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observations by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′ ″	° ′ ″	° ′ ″
West	Direct	0 29 09.5	58 44 00	1 19 03	60 02 33
	Direct	37 10.8	58 43 00		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	56 28.6	58 43 00	1 09 18	59 53 18
	Direct	1 06 48.5	58 45 00		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					59 57 55

Error of chronometer + 2*h.* 33*m.* 00*s.*

Station, Camp 63, *Rio Rita. Date, November* 12, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	4 44 56.1	6 02	29 54	95 32 06
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	4 49 08.1	6 27	31 49	95 55 11
	Direct				
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					95 43 38

Error of chronometer + 2*h.* 34*m.* 53*s.*

OBSERVATIONS—Continued.

Station, Camp 63, *Rio Rita; latitude* 35° 01′ 09″.91; *longitude* 7*h.* 8*m.* 57. 18*s.*
Needle, B. Date, November 12, 1853. *Hour of beginning,* 10 *a. m.; hour of ending,* 10*h.* 45*m. a. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	82	08	
	82	20	
	82	07	
Needle vertical, face of circle south, reading of azimuth circle	81	41	
	82	05	
	81	25	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	81	57	40
Reading of azimuth circle when plane of instrument is in the true meridian	95	43	38
Approximate magnetic declination	13	45	58 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 1 gr.			Def. with wt. 1½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	63 08	75 33	50 35	70	82 08	44 20	69
	63 05	75 45	50 30	------	82 15	44 03	------
	63 10	75 38	50 25	------	82 10	44 05	------
West	63 15	75 45	50 28	------	82 08	44 12	------
	63 10	75 43	50 30	------	82 16	44 10	------
	63 05	75 40	50 07	78	81 55	44 15	75
	° ′ ″	° ′ ″			° ′ ″		°
Means	63 08 50	(1) 75 40 40		74	(1) 82 08 40		72
		(2) 50 25 50			(2) 44 10 50		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	63 17 38						
		° ′ ″			° ′ ″		
Differences	------	25 14 50		------	37 57 50		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	12 37 25		------	18 58 55		------
		° ′ ″			° ′ ″		
Sum of means	------	126 06 30		------	126 19 30		------
		° ′ ″			° ′ ″		
Half sum = dip	------	63 03 15		------	63 09 45		------

OBSERVATIONS—Continued.

Station, Camp 64, *Covèra; latitude* 35° 05′ 22″. 10; *longitude* 7*h*. 09*m*. 45*s*.
Needle, B. Date, November 14, 1853. *Hour of beginning,* 2*h*. 30*m*. *p. m.; hour of ending,* 3*h*. 15*m*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	56	36	
	56	52	
	56	35	
Needle vertical, face of circle south, reading of azimuth circle	57	10	
	57	12	
	57	05	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	56	55	00
Reading of azimuth circle when plane of instrument is in the true meridian	70	44	18
Approximate magnetic declination	13	49	18 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt $2\frac{1}{2}$ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	62 20	87 45	36 25	76	94 45	29 23	76
	62 15	87 50	36 20	------	94 40	29 20	------
	62 23	87 55	36 23	------	94 25	29 18	------
West	62 20	88 03	36 32	------	94 45	29 05	------
	62 18	88 05	36 25	------	94 35	29 20	------
	62 10	88 00	36 28	81	94 38	29 17	81
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	62 17 40	(1) 87 56 20		78.5	(1) 94 38 00		78.5
		(2) 36 25 30		------	(2) 29 17 10		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	62 26 28						
		° ′ ″			° ′ ″		
Differences	------	1 30 50		------	65 20 50		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	25 45 25		------	32 40 25		------
		° ′ ″			° ′ ″		
Sum of means	------	124 21 50		------	123 55 10		------
		° ″			° ′ ″		
Half sum = dip	------	62 10 55		------	61 57 35		------

OBSERVATIONS—Continued.

Station, Camp 64, *Covèra. Date, November* 14, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		m. *s.*	° ′ ″	° ′ ″	° ′ ″
East	Direct	41 17	69 08	1 17 10	70 25 40
	Direct	43 09.5	69 09		
	Reflection				
	Reflection				
West	Reflection				
	Reflection				
	Direct	45 50.6	69 46	1 15 42	71 02 57
	Direct	47 24.5	69 48 30		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations.					70 44 18

Error of chronometer + 2*h.* 35*m.* 51.5*s.*

Station, Camp 65. *Date, November* 15, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ′	° ′ ″
West	Direct	1 05 31.4	42 10	1 09 08	43 19 08
	Direct	1 07 20.8	42 10		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	1 00 00.9	42 30	1 11 11	43 40 11
	Direct	1 01 33.2	42 28		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations.					43 29 39

Error of chronometer + 2*h.* 36*m.* 49*s.*

OBSERVATIONS—Continued.

Station, Camp 65, *Hay Camp; latitude* 35° 4′ 59″. 69; *longitude* 7*h.* 10*m.* 36.8*s.*
Needle, B. Date, November 15, 1853. *Hour of beginning,* 4*h. p. m.; hour of ending,* 4*h.* 45*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	7	34	
	7	40	
	7	39	
Needle vertical, face of circle south, reading of azimuth circle	7	41	
	7	11	
	7	36	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	7	33	30
Reading of azimuth circle when plane of instrument is in the true meridian	43	29	39
Approximate magnetic declination	35	56	09 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	′	°
East	35 35	63 10	7 25	65	71 30	30	65
	35 33	63 15	7 20	------	71 25	33	------
	35 30	63 08	7 28	------	71 30	28	------
West	35 28	63 30	7 00	------	71 33	35	------
	35 26	63 20	7 05	------	71 37	33	------
	35 30	63 28	7 08	65	71 40	38	65
	° ′ ″	° ′ ″		°	° ′ ″		
Means	35 30 20	(1) 63 18 30		65	(1) 71 32 30		------
		(2) 7 14 20			(2) 32 50		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	35 39 08						
		° ′ ″			° ′ ″		
Differences	------	56 04 10		------	70 59 40		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	28 02 05		------	35 29 50		------
		° ′ ″			° ′ ″		
Sum of means	------	70 32 50		------	72 05 20		------
		° ′ ″			° ′ ″		
Half sum = dip	------	35 16 25		------	36 02 40		------

Instrument-stand rested upon a bed of lava during these observations. J. C. I.

OBSERVATIONS—Continued.

Station, Camp 67, Agua Fria ; latitude 35° 01′ 35″. 56 ; longitude 7h. 11m. 53s.
Needle, B. Date, November 17, 1853. Hour of beginning, 4h. 30m. p. m. ; hour of ending, 5h. 10m. p. m.
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	7	22	
	7	19	
	7	30	
Needle vertical, face of circle south, reading of azimuth circle	7	46	
	7	35	
	7	41	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	7	32	10
Reading of azimuth circle when plane of instrument is in the true meridian	20	57	42
Approximate magnetic declination	13	25	32 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East.	61 60	87 45	36 05	46	94 15	28 50	46
	61 50	87 35	36 03	------	94 20	28 47	------
	61 70	87 45	36 08	------	94 25	28 60	------
West	61 55	87 28	35 50	------	94 15	28 40	------
	61 57	87 30	36 10	------	94 20	28 45	------
	61 45	87 25	35 58	46	94 18	28 48	46
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 56 10	(1) 87 34 40		46	(1) 94 18 50		46
		(2) 36 02 20			(2) 28 48 20		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	62 04 58						
		° ′ ″			° ′ ″		
Differences	------	51 32 20		------	65 30 30		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	25 46 10		------	32 45 15		------
		° ′ ″			° ′		
Sum of means	------	123 37 00		------	123 07 10		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 48 30		------	61 33 35		------

OBSERVATIONS—Continued.

Station, Camp 67, *Agua Fria. Date, November* 17, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	3 28 57.8	20 39	7 26	20 47 26
	Direct	3 29 56.1	20 41		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	3 21 52.5	20 56	10 29	21 07 59
	Direct	3 24 22.9	20 59		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					20 57 42

Error of chronometer 2*h.* 38*m.* 14.9*s.*

Station, Camp 68, *Inscription Rock. Date, November* 18, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	1 09 47.5	38 47	1 08 20	39 54 20
	Direct	1 11 54.8	38 45		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	1 04 13	39 00	1 10 29	40 10 29
	Direct	1 05 36.1	39 00		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					40 02 24

Error of chronometer 2*h.* 39*m.* 24.94*s.*

OBSERVATIONS—Continued.

Station, Camp 68, *Inscription Rock; latitude* 35° 2′ 40″.86; *longitude* 7*h.* 12*m.* 57.2*s.*
Needle, B. Date, November 18, 1853. *Hour of beginning,* 4*h.* 30*m. p. m.; hour of ending,* 5*h. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	27	13	
	27	00	
	27	14	
Needle vertical, face of circle south, reading of azimuth circle	27	05	
	27	01	
	27	00	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	27	05	30
Reading of azimuth circle when plane of instrument is in the true meridian	40	02	24
Approximate magnetic declination	12	56	54 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 58	87 58	35 50	43	94 15	28 55	43
	61 53	87 55	35 48	----	94 20	28 45	----
	61 55	87 60	35 50	----	94 15	28 45	----
West	61 57	87 50	35 48	----	94 25	28 45	----
	61 50	87 45	35 45	----	94 30	28 40	----
	61 50	87 40	35 55	43	94 31	28 48	43
	° ′ ″		° ′ ″	°		° ′ ″	°
Means	61 53 50	(1) 87 51 20		43	(1) 94 22 40		43
		(2) 35 49 20			(2) 28 46 20		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	62 2 38						
		° ′ ″			° ′ ″		
Differences	----	52 02 00		----	65 36 20		----
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	----	26 01 00		----	32 48 10		----
		° ′ ″			° ′ ″		
Sum of means	----	123 40 40		----	123 09 00		----
		° ′ ″			° ′ ″		
Half sum = dip	----	61 50 20		----	61 34 30		----

OBSERVATIONS—Continued.

Station, Camp 70, *Zuñi river; latitude* 35° 05′ 41″. 88; *longitude* 7*h*. 14*m*. 35. 56*s*.
Needle, B. Date, November 21, 1853. *Hour of beginning*, 3*h*. *p. m.; hour of ending*, 3*h*. 30*m*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	88	35	
	88	44	
	88	58	
Needle vertical, face of circle south, reading of azimuth circle	88	45	
	88	60	
	88	57	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	88	49	50
Reading of azimuth circle when plane of instrument is in the true meridian	102	13	24
Approximate magnetic declination	13	23	34 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 55	87 50	36 02	73	94 15	28 59	73
	61 50	87 53	36 08	------	94 20	28 60	------
	61 58	87 50	36 01	------	94 25	28 60	------
West	61 55	87 48	36 02	------	94 35	28 50	------
	61 58	87 50	36 00	------	94 30	28 59	------
	61 57	87 47	36 08	75	94 40	28 55	75
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 55 30	(1) 87 49 40		74	(1) 94 27 30		74
		(2) 36 03 30			(2) 28 57 10		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	62 04 18						
		° ′ ″			° ′ ″		
Differences	------	51 46 10		------	65 30 20		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	25 53 05		------	32 45 10		------
		° ′ ″			° ′ ″		
Sum of means	------	123 53 10		------	123 24 40		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 56 35		------	61 42 20		------

OBSERVATIONS—Continued.

Station, Camp 70, *Zuñi river. Date, November* 21, 1853.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	° ′	° ′ ″	° ′ ″
West	Direct	1 07 29	10 51	1 09 45	12 01 15
	Direct	1 10 28.5	10 52		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	1 12 45.3	11 16	1 08 03	12 25 33
	Direct	1 14 22.2	11 19		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					12 13 24

Error of chronometer + 2*h*. 41*m*. 20*s*.

Station, Camp 70, *Zuñi. Latitude* 35° 5′ 41″.88 ; *longitude* 7*h*. 14*m*. 35.56*s*.

Needle, B. Date, November 22, 1853.

Observer, Lieut. J. C. Ives, Topographical Engineers.

	° ′ ″
Needle vertical, face of circle north, reading of azimuth circle	28 38
	28 28
	28 23
Needle vertical, face of circle south, reading of azimuth circle	28 30
	28 40
	28 38
Reading of azimuth circle when plane of instrument is in the magnetic meridian	28 32 50
Reading of azimuth circle when plane of instrument is in the true meridian	

OBSERVATIONS FOR VARIATIONS OF BAROMETER, THERMOMETER, AND MAGNETIC INCLINATION.

Face of Circle East.

Date.	Hours and minutes.	Reading of dip. needle.	No. 790, cistern barometer.	Ther. Fah.	Ther. Att.	Remarks.
1853.	*h. m.*	° ′		°	°	
Nov. 22	2 15 p. m.	61 55	23.988	74.5	-------	Clear sky ; no wind.
	2 30	61 56	23.983	78.5	-------	Do.
	2 45	61 56	23.982	78.0	-------	Do.
	3 00	61 54	23.973	71.5	-------	Do. 3-mile westerly breeze.
	3 15	61 58	23.966	70.0	-------	Do. 5-mile do.
	3 30	62 00	23.965	69.0	-------	Do. 5-mile do.
	3 45	61 58	23.965	68.0	-------	Do. 4-mile do.
	4 00	61 55	23.963	67.0	-------	Do. 3-mile do.
	4 15	62 00	23.958	66.0	-------	Do. 2-mile do.
	4 30	62 00	23.956	65.0	-------	Do. 2-mile do.
	4 45	62 02	23.948	64.0	-------	Do. 2-mile do.
	5 00	61 58	23.940	59.0	-------	Do. no wind.
	5 15	62 05	23.934	57.0	-------	Do. do.

OBSERVATIONS—Continued.

Date.	Hours and minutes.	Reading of dip. needle.	No. 790, cistern barometer.	Ther. Fah.	Ther. Att.	Remarks.
1853.	*h.* *m.*	° ′		°	°	
Nov. 22	5 30 p. m.	62 02	23.934	54.0	--------	Clear sky; no wind.
	5 45	61 49	23.924	52.0	--------	Do. do.
	6 00	61 59	23.940	50.0	41.0	Do. 3-mile easterly wind.
	6 15	61 55	Missed.	48.0	--------	Do.
	6 30	61 58	23.946	48.0	43.0	Do. 2-mile southerly breeze.
	6 45	61 50	23.940	45.0	39.0	Do. no wind.
	7 00	62 03	23.942	43.0	37.0	Do. 3-mile southerly wind.
	7 15	62 00	23.954	42.0	36.0	Do. no wind.
	7 80	62 05	23.958	41.0	36.0	Do. 2-mile southerly breeze.
	7 45	62 03	23.946	39.0	35.0	Do. no wind.
	8 00	62 00	23.938	39.0	35.0	Do. 2-mile southerly breeze.
	8 15	61 58	23.944	39.0	36.0	Do. 2-mile do.
	8 30	62 00	23.950	39.0	35.0	Do. 3-mile easterly breeze.
	8 45	61 58	23.950	39.0	34.0	Do. 3-mile do.
	9 00	61 58	23.950	38.0	34.0	Do. 3-mile northeasterly breeze.
	9 15	61 57	23.950	38.0	33.0	Do. 4-mile easterly breeze.
	9 30	61 50.	23.944	37.0	33.0	Do. 2-mile southeasterly breeze.
	9 45	61 50	23.944	36.0	33.0	Do. 2-mile easterly breeze.
	10 00	61 55	23.944	35.0	31.0	Do. 6-mile northeasterly breeze.
	10 15	62 00	23.934	35.0	33.0	Do. 8-mile do.
	10 30	61 57	23.930	35.0	35.0	Do. 12 mile easterly breeze.
	10 45	61 54	23.930	36.0	36.0	Do. 12-mile do.
	11 00	61 55	23.930	36.0	35.0	Do. 12-mile do.
	11 15	61 58	23.926	35.0	35.0	Do. 12-mile do.
	11 30	61 55	23.926	34.0	32.0	Do. 12-mile northeasterly breeze.
	11 45	61 58	23.928	34.0	33.0	Do. 12-mile do.
	12 midn't--	61 56	23.930	33.0	32.0	Do. 10-mile do.
Nov. 23	12 15 a. m.	61 58	23.932	34.0	33.0	Do. 12-mile do.
	12 30	61 57	23.930	34.0	32.0	Do. 14-mile easterly breeze.
	12 45	61 58	23.928	33.0	31.0	Do. 12-mile do.
	1 00	61 59	23.927	32.0	30.0	Do. 14-mile do.
	1 15	61 59	23.930	35.0	35.0	Do. 15-mile do.
	1 30	61 57	23.922	35.0	35.0	Do. 9-mile northeasterly breeze.
	1 45	61 58	23.924	37.0	36.0	Do. 16-mile easterly breeze.
	2 00	61 55	23.926	39.0	39.0	Do. 16-mile do.
	2 15	61 57	23.926	38.0	37.0	Do. 15 mile do.
	2 30	61 57	23.925	36.0	34.0	Do. 15-mile northeasterly wind.
	2 45	62 00	23.924	34.0	31.0	Do. 12-mile do.
	3 00	61 59	23.922	35.0	32.0	D0. 12-mile easterly wind.
	3 15	61 55	23.920	35.0	32.0	Do. 12-mile northeasterly wind.
	3 30	62 00	23.916	34.0	31.0	Do. 12-mile do.
	3 45	62 00	23.916	34.0	31.0	Do. 12-mile do.
	4 00	62 00	23.920	35.0	34.0	Do. 14-mile do.
	4 15	61 58	23.922	35.0	36.0	Do. 14-mile easterly wind.
	4 30	61 59	23.914	35.0	36.0	Do. 14-mile do.
	4 45	62 00	23.912	36.0	37.0	Do. 14-mile do.
	5 00	61 55	23.911	39.0	37.0	Do. 15-mile do.
	5 15	61 56	23.910	39.0	36.0	Do. 15-mile do.
	5 30	61 58	23.908	34.0	29.0	Do. 15-mile do.
	5 45	61 59	23.906	32.0	26.0	Do. 15-mile do.
	6 00	61 55	23.905	29.0	24.0	Do. 12-mile do.
	6 15	61 57	23.914	28.0	25.0	Do. 12-mile do.
	6 30	61 58	23.926	26.0	24.0	Do. 12-mile do.
	6 45	61 55	23.924	26.0	24.0	Do. 12-mile do.
	7 00	61 57	23.936	26.0	26.0	Do. 12-mile do.
	7 15	61 59	23.936	27.0	23.0	Do. 10-mile do.
	7 30	61 58	23.938	--------	--------	Do. 14-mile do.
	7 45	61 58	23.940	--------	--------	Do. 14-mile do.
	8 00	61 55	23.952	--------	34.0	Do. 12-mile northeasterly wind.
	8 15	61 56	23.954	36.0	32.0	Do. 12-mile do.
	8 30	61 53	23.960	35.0	35.0	Do. 12-mile do.
	8 45	61 55	23.970	36.0	38.0	Do. 12-mile do.
	9 00	61 55	23.972	38.0	40.0	Do. 10-mile do.
	9 15	61 55	23.988	43.0	47.0	Do. 6-mile easterly wind.
	9 30	61 55	23.994	45.0	49.0	Do. 6-mile do.
	9 45	61 55	23.995	46.0	51.0	Do. 6-mile do.
	10 00	61 55	23.996	47.0	53.0	Do. 4-mile do.
	10 15	61 57	23.999	51.0	58.0	Do. 3-mile do.

OBSERVATIONS—Continued.

Date.	Hours and minutes.	Reading of dip. needle.	No. 790, cistern barometer.	Ther. Fah.	Ther. Att.	Remarks.
1853.	*h. m.*	° ′		°	°	
Nov. 23	10 30 a. m.	61 58	24.005	54.0	60.0	Clear sky; 2-mile easterly wind.
	10 45	61 53	24.019	52.0	65.0	Do. 3-mile do.
	11 00	61 55	24.010	57.0	66.0	Do. 2-mile southerly wind.
	11 15	61 55	24.004	62.0	66.0	Do. no wind.
	11 30	61 56	23.989	65.0	68.0	Do. do.
	11 45	61 56	23.974	67.0	70.0	Do. do.
	12 00 m.	61 55	23.984	70.0	72.0	Do. 2-mile southerly wind.
	12 15 p. m.	61 57	23.992	72.0	78.0	Do. 2-mile do.
	12 30	61 57	23.996	72.0	73.0	Do. 2-mile do.
	12 45	61 57	23.996	72.0	73.0	Do. 2-mile do.
	1 00	61 55	23.996	72.0	73.0	Do. 2-mile do.
	1 15	61 56	23.996	72.0	72.0	Do. 2-mile do.
	1 30	61 58	23.996	72.0	72.0	Do. 2-mile do.
	1 45	61 55	23.968	77.0	75.0	Do. 2-mile do.
	2 00	61 50	23.976	76.0	77.0	Do. 2-mile do.
	2 15	61 55	23.980	79.0	75.0	Do. 2-mile do.

Station, Camp 70, *Zuñi river; latitude* 35° 05′ 41″.9 *; longitude* 7*h.* 14*m.* 35.56*s.*

Needle, C. Date, November 22, 1853. *Hour of beginning,* 1*h. p. m. ; hour of ending,* 1*h.* 30*m. p. m.*

Observer, Lieut. J. C. Ives, Topographical Engineers.

	° ′ ″
Needle vertical, face of circle north, reading of azimuth circle	28 37 28 08 28 40
Needle vertical, face of circle south, reading of azimuth circle	28 14 28 40 28 00
Reading of azimuth circle when plane of instrument is in the magnetic meridian	28 23 10
Reading of azimuth circle when plane of instrument is in the true meridian	
Approximate magnetic declination	

OBSERVATIONS FOR MAGNETIC INCLINATION—No. 1.

Face of circle.	With marked end of needle, N. pole.		Thermometer Fahrenheit.	With marked end of needle, S. pole.		Thermometer Fahrenheit.
	North end of needle reads—	South end of needle reads—		North end of needle reads—	South end of needle reads—	
	° ″	° ′	°	° ′	° ′	°
East.	62 05	62 13	76	61 45	61 50	76
	62 13	62 18	----------	62 00	61 57	----------
	62 00	62 05	----------	61 48	61 50	----------
West	62 00	61 50	----------	62 03	62 00	----------
	62 10	62 00	----------	62 05	62 00	----------
	62 08	61 58	76	62 13	62 12	76
	° ′ ″	° ′ ″	°	° ′ ″	° ′ ″	°
Means.	62 06 00	62 04 00	76	61 59 00	61 58 10	76

Mean result for magnetic inclination = 62 01 47

OBSERVATIONS—Continued.

Station, Camp 71, *Arch Spring; latitude* 35° 04′ 45″.10; *longitude* 7*h.* 15*m.* 10.39*s.*
Needle, B. Date, November 26, 1853. *Hour of beginning,* 4*h.* 30*m. p. m.; hour of ending,* 5*h. p. m.*
Observer, Lieut. J. C. Ives, Topographcial Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	68	05	
	68	12	
	68	20	
Needle vertical, face of circle south, reading of azimuth circle	68	10	
	68	30	
	68	20	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	68	16	10
Reading of azimuth circle when plane of instrument is in the true meridian			
Approximate magnetic declination			

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 48	87 30	35 45	55	94 10	28 40	55
	61 50	87 40	35 50	------	94 30	28 25	------
	61 50	87 25	35 50	------	94 15	28 45	------
West	61 47	87 35	35 55	------	94 25	28 40	------
	61 45	87 45	35 58	------	94 20	28 55	------
	61 40	87 50	35 52	55	94 32	28 50	55
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 46 40	(1) 87 37 30		55	(1) 94 22 00		55
		(2) 35 51 40			(2) 28 42 30		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 55 28						
		° ′ ″			° ′ ″		
Differences	------	51 45 50		------	65 39 30		
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	25 52 55		------	32 49 45		------
		° ′ ″			° ′ ″		
Sum of means	------	123 29 10		------	123 04 30		------
		° ′ ′			° ′ ″		
Half sum = dip	------	61 44 35		------	61 32 15		------

Night cloudy; no observations on Polaris for declination.

OBSERVATIONS—Continued.

Station, Camp 72, Cedar Forest; latitude 35° 1′ 13″.23; longitude 7h. 15m. 38.46s.
Needle, B. Date, November 28, 1853. Hour of beginning, 3h. 30m. p. m.; hour of ending, 4h p. m.
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	″	″
Needle vertical, face of circle north, reading of azimuth circle	90	06	
	90	08	
	96	06	
Needle vertical, face of circle south, reading of azimuth circle	90	00	
	90	05	
	90	02	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	90	04	30
Reading of amizuth circle when plane of instrument is in the true meridian	103	05	53
Approximate magnetic declination	13	01	23 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 33	87 40	35 37	56	94 03	28 25	56
	61 28	87 30	35 28	----	94 05	28 30	----
	61 35	87 45	35 32	----	94 10	28 30	----
West	61 30	87 32	35 40	----	94 08	28 30	----
	61 32	87 25	35 38	----	94 12	28 25	----
	61 31	87 30	35 37	55	94 15	28 29	55
	° ′ ″			°			°
Means	61 31 30	(1) 87 33 40		55.5	(1) 94 08 50		55.5
		(2) 35 35 20			(2) 28 28 10		
	′ ″						
Corr. for index error of needle	+ 8 48						
	′ ″						
Deduced inclination	61 40 18						
		° ′ ″			° ′ ″		
Differences	----	51 58 20		----	65 40 40		----
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	----	25 59 10		----	32 50 20		----
		° ′ ″			° ′ ″		
Sum of means	----	123 09 00		----	122 37 00		----
		° ′ ″			° ′ ″		
Half sum = dip	----	61 34 30		----	61 18 30		----

OBSERVATIONS—Continued.

Station, Camp 72. *Date, November* 28, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′	° ′ ″
West	Direct	1 48 02.1	12 00	54 50	12 54 50
	Direct	1 49 13.9	12 00		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	1 51 21.9	12 23	53 27	13 16 57
	Direct	1 52 05.5	12 24		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					13 05 53

Error of chronometer + 2*h.* 42*m.* 46*s.*

Station, Camp 73. *Date, November* 29, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	1 23 16.3	82 05	1 05 08	83 10
	Direct	1 24 39.9	82 05		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	1 27 13.1	82 30	1 03 35	83 34 35
	Direct	1 28 53.2	82 32		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					83 22 21

Error of chronometer + 2*h.* 44*m.* 11.01*s.*

OBSERVATIONS—Continued.

Station, Camp 73, Jacob's Well; latitude 35° 03′ 53″.49; longitude 7h. 16m. 56.38s.
Needle, B. Date, November 29, 1853. Hour of beginning, 5h. 40m. p. m.; hour of ending, 6h. 20m. p. m.
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	69	30	
	69	32	
	69	48	
Needle vertical, face of circle south, reading of azimuth circle	69	40	
	69	32	
	69	50	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	69	38	40
Reading of azimuth circle when plane of instrument is in the true meridian	83	22	21
Approximate magnetic declination	13	43	41 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. $2\frac{1}{2}$ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	
East	61 50	87 50	35 30	43	94 18	28 35	----
	61 55	87 45	35 35	----	94 20	28 40	----
	61 50	87 55	35 36	----	94 10	28 32	----
West	61 50	87 50	35 50	----	94 25	28 35	----
	61 45	87 45	35 40	----	94 30	28 30	----
	61 55	87 45	35 35	40	94 35	28 40	----
	° ′ ″	° ′ ″		°	° ′ ″		
Means	61 50 50	(1) 87 48 20		41.5	(1) 94 23 00		----
		(2) 35 37 40			(2) 28 35 20		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 59 38						
		° ′ ″			° ′ ″		
Differences	----	52 10 40		----	65 47 40		----
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	----	26 05 20		----	32 53 50		----
		° ′ ″			° ′ ″		
Sum of means	----	123 26 00		----	122 58 20		----
		° ′ ″			° ′ ″		
Half sum = dip	----	61 43 00		----	61 29 10		----

OBSERVATIONS—Continued.

Station, Camp 74, *Navajo Spring; latitude* 35° 06′ 19″.44; *longitude* 7*h.* 17*m.* 20. 65*s.*

Needle, B. Date, November 30, 1853. *Hour of beginning,* 2*h. p. m.; hour of ending,* 2*h.* 30*m. p. m.*

Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	60	51	
	60	44	
	60	45	
Needle vertical, face of circle south, reading of azimuth circle	60	50	
	60	34	
	60	30	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	60	42	20
Reading of azimuth circle when plane of instrument is in the true meridian	74	05	39
Approximate magnetic declination	13	23	19 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 45	87 40	35 45	62	94 40	28 30	62
	61 42	87 50	35 40	------	94 35	28 40	------
	61 50	87 40	35 45	------	94 38	28 35	------
West	61 50	87 55	35 50	------	94 45	28 40	------
	61 55	67 45	35 60	------	94 40	28 35	------
	61 53	87 55	35 55	64	94 35	28 43	64
	° ′ ″	° ′ ″		°	° ′ ″		
Means	61 49 10	(1) 87 47 30		63	(1) 94 38 50		------
		(2) 35 49 10			(2) 28 37 10		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 57 58						
		° ′ ″			° ′ ″		
Differences	------	51 58 20		------	66 01 40		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	25 59 10		------	33 00 50		------
		° ′ ″			° ′ ″		
Sum of means	------	123 36 40		------	123 16 00		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 48 20		------	61 38 00		------

OBSERVATIONS—Continued.

Station, Camp 74. *Date, November* 30, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	2 07 46.5	73 05	47 24	73 52 24
	Direct.	2 08 36.2	73 05		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct.	2 03 44.3	73 30	48 24	74 18 54
	Direct.	2 05 19.9	73 31		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					74 05 39

Error of chronometer + 2*h.* 44*m.* 37.9*s.*

Station, Camp 75. *Date, December* 1, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	2 38 14.5	51 46	34 24	52 20 54
	Direct	2 39 06.2	51 47		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	2 33 16.1	52 07	36 38	52 44 08
	Direct	2 34 20.2	52 08		
Reading of azimuth circle when plane of instruments is in the true meridian, by mean of four observations					52 32 31

Error of chronometer + 2*h.* 45*m.* 31.9*s.*

OBSERVATIONS—Continued.

Station, Camp 75, Carriso Creek; latitude 35° 06′ 32″.35 *; longitude* 7*h.* 18*m.* 08.08*s.*
Needle, B. Date, December 1, 1853. *Hour of beginning,* 4*h. p. m.; hour of ending,* 4*h.* 30*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	38	48	
	38	32	
	38	41	
Needle vertical, face of circle south, reading of azimuth circle	38	42	
	38	40	
	38	30	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38	38	50
Reading of azimuth circle when plane of instrument is in the true meridian	52	32	31
Approximate magnetic declination	13	53	41 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 55	87 58	35 40	61	94 35	28 45	61
	61 58	87 55	35 45	------	94 55	28 48	------
	61 60	87 60	35 55	------	94 45	28 45	------
West	61 53	87 50	35 50	------	94 40	28 35	------
	61 58	87 48	35 48	------	94 50	28 40	------
	61 60	87 53	35 53	61	94 45	28 38	61
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 57 20	(1) 87 54 00		61	(1) 94 45 00		61
		(2) 35 48 30			(2) 28 41 50		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	62 05 08						
		° ′ ″			° ′ ″		
Differences	------	52 05 30		------	66 03 10		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	26 02 45		------	33 01 35		------
		° ′ ″			° ′ ″		
Sum of means	------	123 42 30		------	123 26 50		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 51 15		------	61 43 25		------

OBSERVATIONS—Continued.

Station, Camp 76, near Lithodendron Creek; latitude 35° 02′ 07″.83; longitude 7h. 18m. 43.26s.
Needle, B. Date, December 2, 1853. Hour of beginning, 4h. p. m.; hour of ending, 4h. 30m. p. m.
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	56	36	
	56	50	
	56	37	
Needle vertical, face of circle south, reading of azimuth circle	56	34	
	56	23	
	56	52	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	56	38	40
Reading of azimuth circle when plane of instrument is in the true meridian	70	11	18
Approximate magnetic declination	13	32	38 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′ ″	° ′	° ′	°	° ′	° ″	°
East	61 45	87 30	35 33	59	94 50	28 29	59
	61 45	87 35	35 35	------	94 40	28 25	------
	61 55	87 40	35 40	------	94 40	28 28	------
West	61 48	87 30	35 30	------	94 55	28 25	------
	61 45	87 55	35 30	------	94 45	28 20	------
	61 50	87 58	35 35	59	94 40	28 28	59
	° ′ ″	° ′ ″		°	° ′ ″		
Means	61 48 00	(1) 87 41 20		59	(1) 94 45 00		------
		(2) 35 33 50			(2) 28 25 50		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 56 48						
		° ′ ″			° ′ ″		
Differences	------	52 07 30		------	66 19 10		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	26 03 45		------	33 09 35		------
		° ′ ″			° ′ ″		
Sum of means	------	123 15 10		------	123 10 50		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 37 35		------	61 35 25		------

OBSERVATIONS—Continued.

Station, Camp 76. *Date, December* 2, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chrometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	2 43 55.9	69 29	31 58	70 00 28
	Direct	2 45 22.6	69 28		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	2 48 08	69 52	30 09	70 22 09
	Direct	2 49 07.4	69 52		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					70 11 18

Error of chronometer + 2*h*. 46*m*. 12.3*s*.

Station, Camp 77. *Date, December* 3, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	2 24 53.5	69 05	41 08	69 46 08
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct				
	Direct	2 27 24	69 31	40 02	70 11 02
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					69 58 35

Error of chronometer + 2*h*. 47*m*. 02*s*.2.

OBSERVATIONS—Continued.

Station, Camp 77, near Rio Puerco of the West; latitude 34° 57′ 56″.58; longitude 7h. 19m. 28.82s.
Needle, B. Date, December 3, 1853. Hour of beginning, 4h. 10m. p. m.; hour of ending, 4h. 35m. p. m.
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	55	56	
	55	60	
	55	59	
Needle vertical, face of circle south, reading of azimuth circle	55	59	
	55	60	
	55	57	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	55	58	30
Reading of azimute circle when plane of instrument is in the true meridian	69	58	35
Approximate magnetic declination	14	00	05 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 35	87 40	35 20	62	94 33	28 28	62
	61 38	87 42	35 28	-------	94 40	28 25	-------
	61 40	87 43	35 28	-------	94 30	28 29	-------
West	61 40	87 40	35 20	-------	94 32	28 15	-------
	61 35	87 33	35 10	-------	94 40	28 10	-------
	61 36	87 30	35 20	62	94 36	28 10	62
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 37 20	(1) 87 38 00		62	(1) 94 35 10		62
		(2) 35 21 00			(2) 28 19 30		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 46 08						
		° ′ ″			° ′ ″		
Differences	-------	52 17 00		-------	66 15 40		-------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	-------	26 08 30		-------	33 07 50		-------
		° ′ ″			° ′ ″		
Sum of means	-------	122 59 00		-------	122 54 40		-------
		° ′ ″			° ′ ″		
Half sum = dip	-------	61 29 30		-------	61 27 20		-------

OBSERVATIONS—Continued.

Station, Camp 78, *Colorado Chiquito; latitude* 34° 53′ 01″.95; *longitude* 7*h.* 20*m.* 14.22*s.*
Needle, B. Date, December 5, 1853. *Hour of beginning,* 2*h.* 45*m. p. m.; hour of ending,* 3*h.* 30*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	9	53		
	9	49		
	9	43		
Needle vertical, face of circle south, reading of azimuth circle	9	41		
	9	44		
	9	44		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	9	45	40	
Reading of azimuth circle when plane of instrument is in the true meridian	23	26	02	
Approximate magnetic declination	13	40	22	E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	62 03	88 20	35 60	72	94 58	28 57	72
	62 05	88 25	35 58	------	94 50	28 55	------
	62 10	88 10	35 60	------	94 65	28 59	------
West	62 10	88 00	35 59	------	94 55	28 50	------
	62 06	88 12	35 50	------	94 58	28 47	------
	62 05	88 03	35 55	72	94 60	28 55	72
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	62 06 30	(1) 88 11 40		72	(1) 94 57 40		72
		(2) 35 57 00			(2) 28 53 50		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	62 15 18						
		° ′ ″			° ′ ″		
Differences	------	52 14 40			66 03 50		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	26 07 20		------	33 01 55		------
		° ′ ″			° ′ ″		
Sum of means	------	124 08 40		------	123 51 30		------
		° ′ ″			° ′ ″		
Half sum = dip	------	62 04 20		------	61 55 45		------

OBSERVATIONS—Continued.

Station, Camp 78. *Date, December* 5, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	° ′	′ ″	° ′ ″
West	Direct	2 17 59.5	22 26	44 18	23 10 48
	Direct	2 18 56.0	22 27		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	2 31 39.6	23 03	38 16	23 41 16
	Direct	2 32 41.1	23 03		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					23 26 02

Error of chronometer + 2*h*. 47*m*. 56.4*s*.

Station, Camp 80. *Date, December* 7, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	° ′	′ ″	° ′ ″
West	Direct	2 44 46.5	37 11	32 57	37 44 27
	Direct	2 46 10.6	37 12		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	2 48 03.1	37 40	36 11	38 16 11
	Direct	2 49 14.4	37 40		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					38 00 19

Error of chronometer + 2*h*. 49*m*. 36.5*s*.

OBSERVATIONS—Continued.

Station, Camp 80, *Colorado Chiquito; latitude* 34° 59′ 39″.19; *longitude* 7*h.* 21*m.* 40.60*s.*
Needle, B. Date, December 7, 1853. *Hour of beginning,* 3*h.* 30*m. p. m.; hour of ending,* 4*h. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	24	16	
	24	17	
	24	20	
Needle vertical, face of circle south, reading of azimuth circle	24	21	
	24	15	
	24	35	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	24	20	40
Reading of azimuth circle when plane of instrument is in the true meridian	38	00	19
Approximate magnetic declination	13	39	39 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 40	87 57	35 30	58	94 45	28 20	58
	61 48	87 60	35 30	------	94 55	28 30	------
	61 50	87 58	35 32	----	94 45	28 25	------
West	61 47	87 50	35 30	------	94 48	28 15	------
	61 40	87 45	35 30	------	94 40	28 20	------
	61 45	87 40	35 33	60	94 50	28 25	60
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 45 00	(1) 87 51 40		59	(1) 94 47 10		59
		(2) 35 30 50			(2) 28 22 30		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 53 48						
		° ′ ″			° ′ ″		
Differences	------	52 20 50		------	66 24 40		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	26 10 25		------	33 12 20		------
		° ′ ″			° ′ ″		
Sum of means	------	123 22 30		------	123 09 40		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 41 15		------	61 34 50		------

OBSERVATIONS—Continued.

Station, Camp 81, *Colorado Chiquito; latitude* 35° 01′ 21″. 03; *longitude* 7*h*. 21*m*. 58. 81*s*.
Needle, B. Date, December 8, 1853. *Hour of beginning,* 1*h*. 15*m*. *p. m.; hour of ending,* 1*h*. 40*m*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	40	43	
	40	38	
	40	30	
Needle vertical, face of circle south, reading of azimuth circle	40	53	
	40	43	
	40	46	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	40	42	10
Reading of azimuth circle when plane of instrument is in the true meridian	54	03	01
Approximate magnetic declination	13	20	51 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 35	87 45	35 27	55	94 40	28 10	55
	61 33	87 37	35 30	------	94 50	28 12	------
	61 30	87 35	35 25	------	94 43	28 10	------
West	61 33	87 36	35 20	------	94 40	28 12	------
	61 30	87 40	35 18	------	94 45	28 05	------
	61 30	87 32	35 20	55	94 37	28 07	55
	° ′ ″	° ′ ″		°	° ′ ″		
Means	61 31 50	(1) 87 37 30		55	(1) 94 42 30		------
		(2) 35 23 20			(2) 28 09 20		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 40 38						
		° ′ ″			° ′ ″		
Differences	------	52 14 10		------	66 33 10		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	26 07 05		------	33 16 35		------
		° ′ ″			° ′ ″		
Sum of means	------	123 00 50		------	122 51 50		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 30 25		------	61 25 55		------

ORSERVATIONS—Continued.

Station, Camp 81. *Date, December* 8, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	2 06 40.3	53 00	50 07	53 50 07
	Direct	2 07 28.5	53 00		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	2 09 18.4	53 27	48 56	54 15 56
	Direct	2 10 30.6	53 27		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					54 03 01

Error of chronometer + 2*h.* 50*m.* 01.98*s.*

Station, Camp 108. *Date, January* 28, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	6 23 22.7	75 27	59 12	74 26 18
	Direct	6 24 37.8	75 26		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	6 19 06.7	75 42	57 36	74 44 54
	Direct	6 25 49.6	75 43		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					74 35 36

Error of chronometer + 3*h.* 6*m.* 47.5*s.*

NOTE.—For the remaining magnetic observations at Camp 108, see page 128.

OBSERVATIONS—Continued.

Station, Camp 83, *Colorado Chiquito; latitude* 35° 05′ 18″.26 *longitude;* 7*h.* 22*m.* 12.09*s.*
Needle, B. Date, December 15, 1853. *Hour of beginning,* 11*h.* 30*m. a. m.; hour of ending,* 12*h.* 30*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	22	23	
	22	18	
	22	17	
Needle vertical, face of circle south, reading of azimuth circle	22	30	
	22	36	
	22	40	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	22	27	20
Reading of azimuth circle when plane of instrument is in the true meridian			
Approximate magnetic declination			

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. from the vertical. (2)	Def. towards the vertical. (1)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East.	61 38	87 55	35 18	43	94 40	28 05	20 00	102 25
	61 42	87 50	35 20	------	94 35	28 10	20 05	102 30
	61 40	87 45	35 22	------	94 40	28 12	20 05	102 32
West.	61 33	87 40	35 15	------	94 45	28 03	20 00	102 25
	61 30	87 40	35 20	------	94 30	28 00	20 00	102 15
	61 29	87 50	35 25	41	94 40	28 00	20 02	102 25
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	61 35 20	(1) 87 46 40		42	(1) 94 38 20		(1) 102 25 20	
		(2) 35 20 00			(2) 28 05 00		(2) 20 02 00	
Corr. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 61 44 08							
Differences	----------	° ′ ″ 52 26 40		------	° ′ ″ 66 33 20		° ′ ″ 82 23 20	
Half diff. or angles of deflection	----------	° ′ ″ 26 13 20		------	° ′ ″ 33 16 40		° ′ ″ 41 11 40	
Sum of means	----------	° ′ ″ 123 06 40		------	° ′ ″ 122 43 20		° ′ ″ 122 27 20	
Half sum = dip	----------	° ′ ″ 61 33 20		------	° ′ ″ 61 21 40		° ′ ″ 61 13 40	

Night cloudy; no observations for declination.

OBSERVATIONS—Continued.

Station, Camp 84, *Rio Colorado Chiquito; latitude* 35° 12′ 02″.77; *longitude* 7*h.* 22*m.* 29.64*s.*
Needle, B. Date, December 16, 1853. *Hour of beginning,* 3*h.* 40*m. p. m.; hour of ending,* 4*h.* 10*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	89	00	
	89	11	
	89	00	
Needle vertical, face of circle south, reading of azimuth circle	89	00	
	89	09	
	89	15	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	89	05	50
Reading of azimuth circle when plane of instrument is in the true meridian	102	45	18
Approximate magnetic declination	13	39	28 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East	61 34	87 45	35 28	43	94 30	28 15	102 25	20 20
	61 32	87 48	35 25	------	94 20	28 20	102 15	20 12
	61 40	87 50	35 30	------	94 27	28 18	102 30	20 10
West	61 36	87 50	35 28	------	94 35	28 00	102 25	20 15
	61 38	87 40	35 20	------	94 15	28 10	102 10	20 20
	61 38	87 40	35 28	43	94 40	28 08	102 20	20 15
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ′	
Means	61 36 20	(1) 87 45 30		43	(1) 94 27 50		(1) 102 20 50	
		(2) 35 26 30			(2) 28 11 50		(2) 20 15 20	
	′ ″							
Cor. for index error of needle	+ 8 48							
	° ′ ″							
Deduced inclination	61 45 08							
		° ′ ″			° ′ ″		° ′ ″	
Differences	----------	52 19 00		------	66 16 00		82 05 30	
		° ′ ′			° ′ ″		° ′ ″	
Half diff. or angles of deflection	----------	26 09 30		------	33 08 00		41 02 45	
		° ′ ″			° ′ ″		° ′ ″	
Sum of means	----------	123 12 00		------	122 39 40		122 36 10	
		° ′ ″			° ′ ″		° ′ ″	
Half sum = dip	----------	61 36 00		------	61 19 50		61 18 05	

OBSERVATIONS—Continued.

Station, Camp 84. *Date, December* 16, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	3 12 52.9	12 15		
	Direct	3 13 48.0	12 15	47	12 37 47
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	3 08 44.6	12 31		
	Direct	3 10 20.9	12 33	20 49	12 52 49
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					12 45 18

Error of chronometer + 2*h.* 51*m.* 27.25*s.*

Station, Camp 85. *Date, December* 17, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	′ ″	° ′ ″
West	Direct	2 57 06.5	51 03		
	Direct	2 57 56.6	51 03	29 08	51 32 08
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	2 59 13.5	51 30		
	Direct	3 00 39.5	51 30	28 10	51 58 10
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					51 45 09

Error of chronometer + 2*h.* 52*m.* 26.7*s.*

OBSERVATIONS—Continued.

Station, Camp 85, *Colorado Chiquito; latitude* 35° 18′ 11″.74; *longitude* 7*h.* 23*m.* 31.77*s.*
Needle, B. Date, December 17, 1853. *Hour of beginning,* 4*h.* 55*m. p. m.; hour of ending,* 5*h.* 20*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	38	03	
	38	02	
	38	05	
Needle vertical, face of circle south, reading of azimuth circle	38	05	
	38	03	
	38	03	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	38	03	30
Reading of azimuth circle when plane of instrument is in the true meridian	51	45	09
Approximate magnetic declination	13	41	39 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East.	61 47	87 52	35 30	36	94 35	28 15	102 30	20 30
	61 50	87 59	35 30	------	94 25	28 28	102 25	20 30
	61 46	87 45	35 28	------	94 40	28 27	102 25	20 27
West.	61 47	87 45	35 30	------	94 50	28 20	102 27	20 28
	61 46	87 50	35 32	------	94 59	28 28	102 30	20 18
	61 43	87 45	35 30	36	94 50	28 20	102 32	20 22
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means.	61 46 30	(1) 87 49 20		36	(1) 94 43 10		(1) 102 28 10	
		(2) 35 30 00			(2) 28 23 00		(2) 20 25 50	
Cor. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 61 55 18							
Differences.	------	° ′ ″ 52 19 20		------	° ′ ″ 66 20 10		° ′ ″ 82 02 20	
Half diff. or angles of deflection.	------	° ′ ″ 26 09 40		------	° ′ ″ 33 10 05		° ′ ″ 41 01 10	
Sum of means	------	° ′ ″ 123 19 20		------	° ′ ″ 123 06 10		° ′ ″ 122 54 00	
Half sum = dip.	------	° ′ ″ 61 39 40		------	° ′ ″ 61 33 05		° ′ ″ 61 27 00	

OBSERVATIONS—Continued.

Station, Camp 86, *Colorado Chiquito; latitude* 35° 20′ 54″.12; *longitude* 7*h.* 23*m.* 45.30*s.*
Needle, B. Date, December 18, 1853. *Hour of beginning,* 3*h.* 20*m. p. m.; hour of ending,* 3*h.* 50*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	39	12	
	39	12	
	39	12	
Needle vertical, face of circle south, reading of azimuth circle	39	18	
	39	11	
	39	15	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	39	13	20
Reading of azimuth circle when plane of instrument is in the true meridian			
Approximate magnetic declination			

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East	61 58	87 43	35 45	40	94 35	28 45	102 33	20 48
	61 52	87 45	35 50	------	94 20	28 48	102 28	20 55
	61 60	87 45	35 52	------	94 30	28 45	102 27	20 58
West	61 59	87 38	35 50	------	04 28	28 40	102 28	20 48
	61 50	87 30	35 53	------	94 32	28 38	102 18	20 38
	61 48	87 40	35 45	40	94 30	28 45	102 20	20 35
	° ′ ″	° ′ ″			° ′ ″		° ′ ″	
Means	61 54 30	(1) 87 40 10		40	(1) 94 29 10		(1) 102 25 40	
		(2) 35 49 10			(2) 28 43 30		(2) 20 47 00	
Cor. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 62 03 18							
Differences	------	° ′ ″ 51 51 00		------	° ′ ″ 65 45 40		° ′ ″ 81 38 40	
Half diff. or angles of deflection	------	° ′ ″ 25 55 30		------	° ′ ″ 32 52 50		° ′ ″ 40 49 20	
Sum of means	------	° ′ ″ 123 29 20		------	° ′ ″ 123 12 40		° ′ ″ 123 12 40	
Half sum = dip	------	° ′ ″ 61 44 40		------	° ′ ″ 61 36 20		° ′ ″ 61 36 20	

OBSERVATIONS—Continued.

Station, Camp 91, *Leroux's Spring; latitude* 35° 16′ 48″.77; *longitude* 7*h.* 26*m.* 38. 18*s.*
Needle, B. Date, December 29, 1853. *Hour of beginning,* 3*h.* 40*m. p. m.; hour of ending,* 4*h.* 30*m. p. m.*
Observer, Lieut. A. W. Whipple, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	87	01	
	87	23	
	87	50	
Needle vertical, face of circle south, reading of azimuth circle	87	55	
	87	57	
	87	65	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	87	41	50
Reading of azimuth circle when plane of instrument is in the true meridian	101	34	16
Approximate magnetic declination	13	52	26 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 30	94 30	27 52	44	102 28	19 45	44
	61 28	94 37	27 55	------	102 40	19 40	------
	61 27	94 30	27 55	------	102 28	19 50	------
West	61 15	94 22	27 45	------	102 00	19 30	------
	61 28	94 15	27 58	------	102 12	19 48	------
	61 20	94 15	27 40	38	102 02	19 30	38
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 24 40	(1) 94 24 50		41	(1) 102 18 20		41
		(2) 27 50 50			(2) 19 40 30		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 33 28						
		° ′ ″			° ′ ″		
Differences	------	66 34 00		------	82 37 50		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	33 17 00		------	41 18 55		------
		° ′ ″			° ′ ″		
Sum of means	------	122 15 40		------	121 58 50		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 07 50		------	60 59 25		------

OBSERVATIONS—Continued.

Station, Camp 91, *Leroux's Spring. Date, December* 29, 1853.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	° ′	′ ″	° ′ ″
West.	Direct	3 04 40.2	100 55	26 08	101 22 08
	Direct	3 11 07	100 57		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	3 14 47.1	101 23	22 24	101 46 24
	Direct	3 17 04	101 25		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					101 34 16

Error of chronometer + 2*h.* 56*m.* 57.06*s.*

Station, Camp 96. *Date, January* 9, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	′ ″	′ ″	° ′ ′
West.	Direct	5 20 46.1	49 07	35 01	48 31 59
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	5 16 46	49 30	33 37	48 56 33
	Direct	5 18 28.8	49 30		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of three observations					48 44 16

Error of chronometer + 3*h.* 0*m.* 9.42*s.*

OBSERVATIONS—Continued.

Station. Camp 96, *Cedar Creek; latitude* 35° 20′ 35″.09*; longitude* 7*h.* 29*m.* 18.27*s.*
Needle, B. Date, January 9, 1854. *Hour of beginning,* 3*h.* 30*m. p. m.; hour of ending,* 4*h. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	34	60	
	34	50	
	34	62	
Needle vertical, face of circle south, reading of azimuth circle	34	53	
	34	54	
	34	52	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	34	55	10
Reading of azimuth circle when plane of instrument is in the true meridian	48	44	16
Approximate magnetic declination	13	49	06 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. $2\frac{1}{2}$ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East	61 55	87 50	35 50	44	94 45	28 40	102 45	20 42
	61 60	87 50	35 48	------	94 50	28 35	102 35	20 40
	61 58	87 55	35 45	------	94 40	28 35	102 45	20 40
West	61 60	87 55	35 50	------	94 55	28 40	102 35	20 35
	61 59	87 57	35 47	------	94 50	28 30	102 25	20 37
	61 54	87 50	35 55	44	94 45	28 40	102 30	20 30
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	61 57 40	(1) 87 52 50		44	(1) 94 47 30		(1) 102 35 50	
		(2) 35 49 10			(2) 28 36 40		(2) 20 37 20	
Cor. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 62 06 28							
Differences		° ′ ″ 52 03 40		------	° ′ ″ 66 10 50		° ′ ″ 81 58 30	
Half diff. or angles of deflection		° ′ ″ 26 01 50		------	° ′ ″ 33 05 25		° ′ ″ 40 59 15	
Sum of means		° ′ ″ 123 42 00		------	° ′ ″ 123 24 10		° ′ ″ 123 13 10	
Half sum = dip		° ′ ″ 61 51 00		------	° ′ ″ 61 42 05		° ′ ″ 61 36 35	

OBSERVATIONS—Continued.

Station, Camp 103, *Pueblo Creek; latitude* 34° 56′ 31″; *longitude* 7*h.* 31*m.* 04.60*s.*
Needle, B. Date, January 21, 1854. *Hour of beginning,* 3*h. p. m.; hour of ending,* 3*h.* 40*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	17	25	
	17	50	
	17	33	
Needle vertical, face of circle south, reading of azimuth circle	17	28	
	17	44	
	17	41	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	17	36	50
Reading of azimuth circle when plane of instrument is in the true meridian	31	36	14
Approximate magnetic declination	13	59	24 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ″	° ″	° ′	°	° ′	° ′	° ′	° ′
East	61 05	87 40	34 40	45	94 12	27 28	102 07	19 15
	61 07	87 45	34 55	------	94 30	27 20	102 25	19 10
	61 05	87 30	34 40	------	94 15	27 25	102 15	19 12
West	61 03	87 30	34 45	------	94 25	27 30	102 15	19 15
	61 00	87 33	34 35	------	94 25	27 25	102 20	19 12
	61 05	87 40	34 40	45	94 20	27 20	102 17	19 10
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	61 04 10	(1) 87 36 20		45	(1) 94 21 10		(1) 102 16 30	
		(2) 34 42 30			(2) 27 24 40		(2) 19 12 20	
Corr. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 61 12 58							
Differences	----------	° ′ ″ 52 53 50		------	° ′ ″ 66 56 30		° ′ ″ 83 04 10	
Half diff. or angles of deflection	----------	° ′ ″ 26 26 55		------	° ′ ″ 33 28 15		° ′ ″ 41 32 05	
Sum of means	----------	° ′ ″ 122 18 50		------	° ′ ″ 121 45 50		° ′ ″ 121 28 50	
Half sum = dip	----------	° ′ ″ 61 09 25		------	° ′ ″ 60 52 55		° ′ ″ 60 44 25	

OBSERVATIONS—Continued.

Station, Camp 103. *Date, January* 21, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ″	′ ″	° ′ ″
West	Direct	5 41 28	32 10	42 40	31 26 50
	Direct	5 42 57	32 09		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	5 45 26.9	32 30	44 21	31 45 39
	Direct	5 46 44.3	32 30		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					31 36 14

Error of chronometer + 3*h*. 04*m*. 14.23*s*.

Station, Camp 105. *Date, January* 23, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ′	° ′ ″
West	Direct	7 29 28.8	48 04	1 22 23.8	46 41 36.2
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct				
	Direct	7 32 12.1	48 20	1 23 23	46 56 37
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations.					46 49 06

rror of chronometer + 3*h*. 05*m*. 14.15*s*.

OBSERVATIONS—Continued.

Station, Camp 105, *Williams' river; latitude* 34° 59′ 25″.55; *longitude* 7*h.* 31*m.* 49.95*s.*
Needle, B. Date, January 23, 1854. *Hour of beginning,* 2*h. p. m.; hour of ending,* 2*h.* 30*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	32	04		
	32	04		
	31	53		
Needle vertical, face of circle south, reading of azimuth circle	32	05		
	32	00		
	32	00		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	32	01	00	
Reading of azimuth circle when plane of instrument is in the true meridian	46	49	06	
Approximate magnetic declination	14	48	06	E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East	60 58	87 05	34 28	65	94 25	27 05	102 30	19 00
	60 55	87 15	34 22	------	94 15	27 08	102 30	19 02
	60 57	87 08	34 20	------	94 20	27 13	102 35	19 02
West	60 58	87 30	34 30	------	94 25	27 15	102 28	19 00
	60 60	87 15	34 20	------	94 25	27 10	102 20	19 00
	60 55	87 30	34 28	65	94 30	27 12	102 25	19 05
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	60 57 10	(1) 87 17 10		65	(1) 94 23 20		(1) 102 28 00	
		(2) 34 24 40			(2) 27 10 30		(2) 19 01 30	
Cor. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 61 05 58							
Differences	----------	° ′ ″ 52 52 30		------	° ′ ″ 67 12 50		° ′ ″ 83 26 30	
Half diff or angles of deflection	----------	° ′ ″ 26 26 15		------	° ′ ″ 33 36 25		° ′ ″ 41 43 15	
Sum of means	----------	° ′ ″ 121 41 50		------	° ′ ″ 121 33 50		° ′ ″ 121 29 30	
Half sum = dip	----------	° ′ ″ 60 50 55		------	° ′ ″ 60 46 55		° ′ ″ 60 44 45	

OBSERVATIONS—Continued.

Station, Camp 108, *Williams' river; latitude* 35° 06′ 34″.3; *longitude* 7*h.* 32*m.* 50.75*s.*
Needle, B. Date, January 28, 1854. *Hour of beginning,* 1*h.* 30*m. p. m.; hour of ending,* 1*h.* 50*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	60	59	
	60	50	
	60	56	
Needle vertical, face of circle south, reading of azimuth circle	60	62	
	60	50	
	60	55	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	60	55	20
Reading of azimuth circle when plane of instrument is in the true meridian	74	35	36
Approximate magnetic declination	13	40	16 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ″	° ″	° ′	° ′
East	61 10	87 58	34 07	72	95 35	26 43	103 45	18 20
	61 08	87 62	34 05	------	95 20	26 45	103 35	18 18
	61 10	87 67	34 08	------	95 30	26 40	103 45	18 25
West	61 07	87 50	34 05	------	95 25	26 45	103 15	18 20
	61 10	87 62	34 00	------	95 45	26 40	103 20	18 15
	61 05	87 58	34 10	68	95 25	26 45	103 25	18 15
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	61 08 20	(1) 87 59 30		70	(1) 95 30 00		(1) 103 30 50	
		(2) 34 05 50			(2) 26 43 00		(2) 18 18 50	
Cor. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 61 17 08							
		° ′ ″			° ′ ″		° ′ ″	
Differences	----------	53 53 40		------	68 47 00		85 12 00	
Half diff. or angles of deflection	----------	° ′ ″ 26 56 50		------	° ′ ″ 34 23 30		° ′ ″ 42 36 00	
Sum of means	----------	° ′ ″ 122 05 20		------	° ′ ″ 122 13 00		° ′ ″ 121 49 40	
Half sum = dip	----------	° ′ ″ 61 02 40		------	° ′ ″ 61 06 30		° ′ ″ 60 54 50	

Note.—For the remaining magnetic observations at Camp 108, see page 116.

OBSERVATIONS—Continued.

Station, Camp 109, *Branch of White Cliff Creek; latitude* 35° 12′ 26″.50; *longitude* 7*h*. 33*m*. 25.45*s*.
Needle, B. Date, January 30, 1854. *Hour of beginning,* 4*h*. 45*m*. *p. m.; hour of ending,* 5*h*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	13	40	
	13	38	
	13	45	
Needle vertical, face of circle south, reading of azimuth circle	13	41	
	13	45	
	13	43	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	13	42	00
Reading of azimuth circle when plane of instrument is in the true meridian			
Approximate magnetic declination			

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 10	87 30	34 45	54	94 10	27 33	54
	61 10	87 30	34 55	------	94 18	27 30	------
	61 08	87 25	34 48	------	94 12	27 30	------
West	61 00	87 20	34 45	------	94 15	27 28	------
	61 00	87 15	34 48	------	94 25	27 30	------
	61 05	87 20	34 55	54	94 10	27 25	54
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 05 30	(1) 87 23 20		54	(1) 94 15 00		54
		(2) 34 49 20			(2) 27 29 20		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 14 18						
		° ′ ″			° ′ ″		
Differences	------	52 34 00		------	66 45 40		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	26 17 00		------	33 22 50		------
		° ′ ″			° ′ ″		
Sum of means	------	122 12 40		------	121 44 20		------
		° ′ ″			° ′ ″		
Half sum = dip	------	61 06 20		------	60 52 10		------

Night cloudy; no observations for declination.

OBSERVATIONS—Continued.

Station, Camp 111, *White Cliff Creek; latitude,* 35° 08′ 07″.70; *longitude* 7*h.* 34*m.* 4.64*s.*
Needle, B. Date, February 1, 1854. *Hour of beginning,* 4*h.* 20*m. p. m.; hour of ending,* 4*h.* 45*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	61	02		
	61	05		
	61	11		
Needle vertical, face of circle south, reading of azimuth circle	61	06		
	61	06		
	61	06		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	61	06	00	
Reading of azimuth circle when plane of instrument is in the true meridian	75	48	25	
Approximate magnetic declination	14	42	25	E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East	60 40	87 02	34 15	71	94 30	27 05	102 40	18 60
	60 40	87 05	34 20	------	94 30	27 00	102 40	18 50
	60 40	87 02	34 18	------	94 25	27 03	102 40	18 58
West	60 35	87 08	34 22	------	94 25	27 00	102 15	18 58
	60 45	87 00	34 15	------	94 20	27 05	102 18	18 62
	60 35	87 05	34 15	71	94 25	27 00	102 15	18 55
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	60 39 10	(1) 87 03 40		71	(1) 94 25 50		(1) 102 28 00	
		(2) 34 17 30			(2) 27 02 10		(2) 18 57 10	
Corr. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 60 47 58							
Differences	------	° ′ ″ 52 46 10		------	° ′ ″ 67 23 40		° ′ ″ 83 30 50	
Half diff. or angles of deflection	------	° ′ ″ 26 23 05		------	° ′ ″ 33 41 50		° ′ ″ 41 45 25	
Sum of means	------	° ′ ″ 121 21 10		------	° ′ ″ 121 28 00		° ′ ″ 121 25 10	
Half sum = dip	------	° ′ ″ 60 40 35		------	° ′ ″ 60 44 00		° ′ ″ 60 42 35	

OBSERVATIONS—Continued.

Station, Camp 111. *Date, February* 1, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	° ′	° ′ ″	° ′ ″
West	Direct	9 03 00.5	77 17	1 43 04	75 34 26
	Direct	9 05 26.5	77 18		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	9 07 44.5	77 46	1 43 36	76 02 24
	Direct	9 08 52.9	77 46		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					75 48 25

Error of chronometer + 3*h*. 8*m*. 21*s*.

Station, Camp 112. *Date, February* 4, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	′ ″	° ′ ″	° ′ ″
West	Direct	7 58 50.6	67 50	1 30 04	66 20 56
	Direct	8 00 17.5	67 52		
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct	7 55 12.5	68 17	1 29 11	66 47 19
	Direct	7 57 05.5	68 18		
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of four observations					66 34 07

Error of chronometer + 3*h*. 09*m*. 8.2*s*.

OBSERVATIONS—Continued.

Station, *Camp* 112, *Bighorn Spring*; *latitude* 35° 00′ 51″.53; *longitude* 7*h*. 34*m*. 24.58*s*.
Needle, *B*. *Date*, *February* 4, 1854. *Hour of beginning*, 2*h*. 45*m*. *p*. *m*.; *hour of ending*, 3*h*. 15*m*. *p*. *m*.
Observer, *Lieut*. *J*. *C*. *Ives*, *Topographical Engineers*.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	52	17	
	52	18	
	52	10	
Needle vertical, face of circle south, reading of azimuth circle	52	15	
	52	20	
	52	17	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	52	16	10
Reading of azimuth circle when plane of instrument is in the true meridian	66	34	07
Approximate magnetic declination	14	17	57 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East.	60 55	87 25	33 63	73	94 45	26 40	102 58	18 30
	60 50	87 25	33 63	------	94 50	26 45	102 50	18 28
	60 55	87 30	33 63	------	94 45	26 45	102 60	18 25
West.	60 55	87 25	33 45	------	94 45	26 40	102 50	18 20
	69 50	87 20	33 60	------	94 50	26 35	102 55	18 30
	60 53	87 18	33 50	73	94 40	26 35	102 55	18 15
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	60 53 00	(1) 87 23 50		73	(1) 94 45 50		(1) 102 54 40	
		(2) 33 57 20			(2) 26 40 00		(2) 18 24 40	
Cor. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 61 01 48							
Differences.	------	° ′ ″ 53 26 30		------	° ′ ″ 68 05 50		° ′ ″ 84 30 00	
Half diff. or angles of deflection	------	° ′ ″ 26 43 15		------	° ′ ″ 34 02 55		° ′ ″ 42 15 00	
Sum of means	------	° ′ ″ 121 21 10		------	° ′ ″ 121 25 50		° ′ ″ 121 19 20	
Half sum = dip	------	° ′ ″ 60 40 35		------	° ′ ″ 60 42 55		° ′ ″ 60 39 40	

OBSERVATIONS—Continued.

Station, Camp 116, *Williams' River; latitude* 34° 35′ 36″. 90; *longitude* 7*h*. 33*m*. 51.17*s*.
Needle, B. Date, February 8, 1854. *Hour of beginning*, 4*h*. 30*m*. *p. m.*; *hour of ending*, 5*h*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	71	55	
	71	55	
	71	55	
Needle vertical, face of circle south, reading of azimuth circle	71	57	
	71	50	
	71	57	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	71	54	50
Reading of azimuth circle when plane of instrument is in the true meridian	85	56	59
Approximate magnetic declination	14	02	09 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East	60 30	87 15	33 20	67	94 35	26 15	102 50	17 45
	60 23	87 15	33 30	------	94 50	26 20	102 45	17 50
	60 30	87 15	33 40	------	94 45	26 12	102 45	17 40
West	60 25	87 15	33 20	------	94 45	26 00	102 45	17 30
	60 35	87 20	33 30	------	94 45	26 20	102 45	17 30
	60 20	87 08	33 20	67	94 30	26 15	102 50	17 45
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	60 27 10	(1) 87 14 40		67	(1) 94 41 40		(1) 102 46 40	
		(2) 33 26 40			(2) 26 13 40		(2) 17 40 00	
Cor. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 60 35 58							
		° ′ ″			° ′ ″		° ′ ″	
Differences	----------	53 48 00		------	68 28 00		85 06 40	
Half diff. or angles of deflection	----------	° ′ ″ 26 54 00		------	° ′ ″ 34 14 00		° ′ ″ 42 33 20	
Sum of means	----------	° ′ ″ 120 41 20		------	° ′ ″ 120 55 20		° ′ ″ 120 26 40	
Half sum = dip.	----------	° ′ ″ 60 20 40		------	° ′ ″ 60 27 40		° ′ ″ 60 13 20	

OBSERVATIONS—Continued.

Station, Camp 116. *Date, February* 8, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	6 50 35.1	86 52	1 07 58	85 44 02
	Direct				
	Reflection.				
	Reflection.				
East	Reflection.				
	Reflection.				
	Direct				
	Direct	6 48 05.5	87 17	1 07 03	86 09 57
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					85 56 59

Error of chronometer + 3*h*. 9*m*. 34. 8*s*.

Station, Camp 117. *Date, February* 9, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	6 48 26.6	7 00	1 07 07	5 52 53
	Direct				
	Reflection.				
	Reflection.				
East	Reflection				
	Reflection				
	Direct				
	Direct	6 46 05.5	7 26	1 06 16	6 19 44
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					6 06 18

Error of chronometer + 3*h*. 09*m*. 33. 1*s*.

OBSERVATIONS—Continued.

Station, Camp 117, *Williams' River; latitude* 34° 32′ 29″. 60; *longitude* 7*h*. 33*m*. 50. 30*s*.
Needle, B. Date, February 9, 1854. *Hour of beginning*, 2*h*. 30*m*. *p. m.*; *hour of ending*, 2*h*. 55*m*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	82	00	
	82	00	
	82	15	
Needle vertical, face of circle south, reading of azimuth circle	82	10	
	82	20	
	82	05	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	82	08	20
Reading of azimuth circle when plane of instrument is in the true meridian	96	06	18
Approximate magnetic declination	13	57	58 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East.	60 33	87 20	33 50	78	94 58	26 30	102 60	18 05
	60 35	87 25	33 50	------	94 55	26 25	102 45	18 12
	60 35	87 25	33 52	------	94 45	26 28	102 58	18 15
West.	60 38	87 15	33 60	------	94 55	26 25	102 50	18 05
	60 38	87 30	33 45	------	94 40	26 35	102 45	18 15
	60 30	87 20	33 50	78	94 50	26 20	102 55	18 05
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means.	60 34 50	(1) 87 22 30		78	(1) 94 50 30		(1) 102 52 10	
		(2) 33 51 10			(2) 26 27 10		(2) 18 09 30	
Cor. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 60 43 38							
Differences		° ′ ″ 53 31 20		------	° ′ ″ 68 23 20		° ′ ″ 84 42 40	
Half diff. or angles of deflection		° ′ 26 45 40		------	° ′ ″ 34 11 40		° ′ ″ 42 21 20	
Sum of means		° ′ ″ 121 13 40		------	° ′ ″ 121 17 40		° ′ ″ 121 01 40	
Half sum = dip		° ′ ″ 60 36 50		------	° ′ ″ 60 38 50		° ′ ″ 60 30 50	

OBSERVATIONS—Continued.

Station, Camp 121, *Williams' River ; latitude* 34° 16′ 51″. 10 ; *longitude* 7*h.* 33*m.* 44.83*s.*
Needle, B. Date, February 13, 1854. *Hour of beginning,* 3*h.* 30*m. p. m. ; hour of ending,* 4*h. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	57	52	
	57	52	
	57	50	
Needle vertical, face of circle south, reading of azimuth circle	57	51	
	57	51	
	57	50	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	57	51	00
Reading of azimuth circle when plane of instrument is in the true meridian	71	15	19
Approximate magnetic declination	13	24	19 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2 gr.			Def. with wt. 2½ gr.		Def. with wt. 3 gr.	
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Def. towards the vertical. (1)	Def. from the vertical. (2)
	° ′	° ′	° ′	°	° ′	° ′	° ′	° ′
East.	60 15	86 50	33 30	63	94 15	25 60	102 15	17 50
	60 15	86 48	33 30	------	94 20	25 60	102 25	17 48
	60 22	86 45	33 33	------	94 08	25 52	102 15	17 50
West.	60 15	86 40	33 25	------	94 05	25 58	102 20	17 45
	60 15	86 50	33 15	------	94 05	25 60	102 18	17 40
	60 12	86 45	33 25	63	94 15	25 60	102 10	17 50
	° ′ ″	° ′ ″		°	° ′ ″		° ′ ″	
Means	60 15 40	(1) 86 46 20		63	(1) 94 11 20		(1) 102 17 10	
		(2) 33 26 20			(2) 25 58 20		(2) 17 47 10	
Corr. for index error of needle	′ ″ + 8 48							
Deduced inclination	° ′ ″ 60 24 28							
Differences		° ′ ″ 53 20 00		------	° ′ ″ 68 13 00		° ′ ″ 84 30 00	
Half diff. or angles of deflection		° ′ ″ 26 40 00		------	° ′ ″ 34 06 30		° ′ ″ 42 15 00	
Sum of means		° ′ ″ 120 12 40		------	° ′ ″ 120 09 40		° ′ ″ 120 04 20	
Half sum = dip.		° ′ ″ 60 06 20		------	° ′ ″ 60 04 50		° ′ ″ 60 02 10	

OBSERVATIONS—Continued.

Station, Camp 121. *Date, February* 13, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	7 44 07.9	72 27	1 24 48	71 02 12
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct				
	Direct	7 43 12.3	72 53	1 24 34	71 28 26
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					71 15 19

Error of chronometer + 3*h*. 10*m*. 22.4*s*.

Station, Camp 122. *Date, February* 15, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	7 17 22.6	78 45	1 16 18	77 28 42
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct				
	Direct	7 19 03	79 20	1 17 40	78 02 20
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					77 45 31

OBSERVATIONS—Continued.

Station, Camp 122, *Williams' River; latitude* 34° 12′ 32″. 40; *longitude* 7*h*. 34*m*. 12. 19*s*.
Needle, B. Date, February 15, 1854. *Hour of beginning*, 5*h*. *p. m.*; *hour of ending*, 5*h*. 20*m*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	64	06	
	64	06	
	64	08	
Needle vertical, face of circle south, reading of azimuth circle	64	04	
	64	00	
	64	05	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	64	04	50
Reading of azimuth circle when plane of instrument is in the true meridian	77	45	31
Approximate magnetic declination	13	40	41 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. $2\frac{1}{2}$ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	59 58	93 58	25 58	56	102 20	17 45	56
	59 58	93 60	25 60	------	102 20	17 50	------
	59 60	93 55	25 60	------	102 30	17 50	------
West	59 60	93 60	25 55	------	102 20	17 45	------
	59 58	93 58	25 60	------	102 15	17 45	------
	59 60	93 58	25 50	56	102 15	17 40	56
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	59 59 00	(1) 93 58 10		56	(1) 102 20 00		56
		(2) 25 57 10			(2) 17 45 50		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 07 48						
		° ′ ″			° ′ ″		
Differences	------	68 01 00		------	84 34 10		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	34 00 30		------	42 17 05		------
		° ′ ″			° ′ ″		
Sum of means	------	119 55 20		------	120 05 50		------
		° ′ ″			° ′ ″		
Half sum = dip	------	59 57 40		------	60 02 55		------

OBSERVATIONS—Continued.

Station, Camp 123, *Williams' River; latitude* 34° 13′ 44″. 10; *longitude* 7*h*. 34*m*. 36.77*s*.
Needle, B. Date, February 16, 1854. *Hour of beginning*, 3*h*. 40*m*. *p. m.*; *hour of ending*, 4*h*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	93	34	
	93	34	
	93	34	
Needle vertical, face of circle south, reading of azimuth circle	93	31	
	93	40	
	93	31	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	93	34	00
Reading of azimuth circle when plane of instrument is in the true meridian			
Approximate magnetic declination			

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. $2\frac{1}{2}$ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 00	94 05	25 57	72	102 20	17 30	72
	60 02	94 18	25 55	------	102 35	17 40	------
	60 00	94 05	25 50	------	102 30	17 30	------
West	60 02	94 18	25 58	------	102 20	17 25	------
	60 02	94 10	25 60	------	102 20	17 35	------
	60 00	94 12	25 60	72	102 15	17 30	72
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	60 01 00	(1) 94 11 20		72	(1) 102 23 20		72
		(2) 25 56 40			(2) 17 31 40		
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 09 48						
		° ′ ″			° ′ ″		
Differences	------	68 14 40		------	84 51 40		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	34 07 20		------	42 25 50		------
		° ′ ″			° ′ ″		
Sum of means	------	120 08 00		------	119 55 00		------
		° ′ ″			° ′ ″		
Half sum = dip	------	60 04 00		------	59 57 30		------

Night cloudy. No observations for declination.

OBSERVATIONS—Continued.

Station, mouth of Williams' River; latitude 34° 17′ 46″.58; *longitude* 7*h.* 36*m.* 00*s.*
Needle, B. Date, February 20, 1854. *Hour of beginning,* 11*h.* 20*m. a. m.; hour of ending,* 12*h. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	° ′ ″
Needle vertical, face of circle north, reading of azimuth circle	79 46 79 47 79 47
Needle vertical, face of circle south, reading of azimuth circle	79 75 79 75 79 52
Reading of azimuth circle when plane of instrument is in the magnetic meridian	79 57 00
Reading of azimuth circle when plane of instrument is in the true meridian	
Approximate magnetic declination	

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 5 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 00	94 12	25 50	77	102 20	17 30	77
	60 05	94 10	25 55	------	102 25	17 25	------
	60 03	94 10	25 50	------	102 25	17 30	------
West	60 03	94 03	25 50	------	102 25	17 20	------
	60 04	94 02	25 48	------	102 15	17 20	------
	60 00	94 10	25 55	77	102 20	17 22	77
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	60 02 30	(1) 94 07 50 (2) 25 51 20		77	(1) 102 21 40 (2) 17 24 30		77
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 11 18						
		° ′ ″			° ′ ″		
Differences	------	68 16 30		------	84 57 10		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	34 08 15		------	42 28 35		------
		° ′ ″			° ′ ″		
Sum of means	------	119 59 10		------	119 46 10		
		° ′ ″			° ′ ″		
Half sum = dip	------	59 59 35		------	59 53 05		------

No observations for declination.

OBSERVATIONS—Continued.

Station, Camp 128, *Rio Colorado; latitude* 34° 23′ 10″.10; *longitude* 7*h.* 36*m.* 25.66*s.*
Needle, B. Date, February 21, 1854. *Hour of beginning,* 3*h.* 15*m. p. m.; hour of ending,* 3*h.* 30*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	72	25	
	72	30	
	72	30	
Needle vertical, face of circle south, reading of azimuth circle	72	30	
	72	38	
	72	32	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	72	30	50
Reading of azimuth circle when plane of instrument is in the true meridian	86	38	39
Approximate magnetic declination	14	07	49 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fahr.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 23	94 28	26 12	75	102 32	17 60	75
	60 27	94 25	26 15	----	192 30	17 58	----
	60 30	94 25	26 15	----	102 40	17 62	----
West	60 28	94 33	26 12	----	102 28	17 50	----
	60 25	94 30	26 05	----	102 30	17 55	----
	60 21	94 32	26 10	75	102 20	17 50	75
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	60 25 40	(1) 94 28 50		75	(1) 102 30 00		75
		(2) 26 11 30			(2) 17 55 50		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 34 28						
		° ′ ″			° ′ ″		
Differences	----	68 17 20		----	84 34 10		----
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	----	34 08 40		----	42 17 05		----
		° ′ ″			° ′ ″		
Sum of means	----	120 40 20		----	120 25 50		----
		° ′ ″			° ′ ″		
Half sum = dip	----	60 20 10		----	60 12 55		----

OBSERVATIONS—Continued.

Station, Camp 128. *Date, February* 21, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	9 50 57.5	88 10	1 45 56	86 24 04
East	Direct	9 47 59.9	88 39	1 45 46	86 53 14
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					86 38 39

Error of chronometer + 3*h*. 14*m*. 46.6*s*.

Station, Camp 130. *Date, February* 23, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	8 10 58	75 16	1 30 53	73 45 07
East	Direct	8 09 05.5	75 46	1 30 25	74 15 35
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations.					74 00 21

Error of chronometer + 3*h*. 15*m*. 53.6*s*.

Station, Camp 132. *Date, February* 25, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	8 28 45.5	34 23	1 35 04	32 47 56
East	Direct	8 26 30.6	34 54	1 34 34	33 19 26
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					33 03 41

Error of chronometer + 3*h*. 16*m*. 33.5*s*.

OBSERVATIONS—Continued.

Station, Camp 129, *Rio Colorado; latitude* 34° 27′ 26″.44; *longitude* 7*h.* 36*m.* 45.24*s.*
Needle, B. Date, February 22, 1854. *Hour of beginning,* 5*h. p. m.; hour of ending,* 5*h.* 30*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	° ′ ″
Needle vertical, face of circle north, reading of azimuth circle	66 45 66 51 66 60
Needle vertical, face of circle south, reading of azimuth circle	66 52 66 52 66 42
Reading of azimuth circle when plane of instrument is in the magnetic meridian	66 50 20
Reading of azimuth circle when plane of instrument is in the true meridian	
Approximate magnetic declination	

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 25	94 25	26 08	65	102 40	17 60	65
	60 28	94 30	26 10	------	102 35	17 55	------
	60 25	94 28	26 10	------	102 48	17 58	------
West	60 25	94 20	*26 45	------	102 40	17 58	------
	60 27	94 25	*26 60	------	102 45	17 50	------
	60 25	94 20	*26 58	65	102 50	17 40	65
	° ′ ″		° ′ ″	°		° ′ ″	°
Means	60 25 50	(1) 94 24 40 (2) 26 31 50		65	(1) 102 43 10 (2) 17 53 30		65
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 34 38						
		° ′ ″			° ′ ″		
Differences	------	67 52 50		------	84 49 40		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	33 56 25		------	42 24 50		------
		° ′ ″			° ′ ″		
Sum of means	------	120 56 30		------	120 36 40		------
		° ′ ″		------	° ′ ″		
Half sum = dip	------	60 28 15			60 18 20		------

* For these three observations the number of degrees first recorded in the primary note-book were "25°". Afterwards they were changed to "26°". It is believed that the original record was correct. A. W. W.

OBSERVATIONS—Continued.

Station, Camp 130, *Rio Colorado; latitude* 34° 36′ 19″. 20; *longitude* 7*h*. 37*m*. 4.36*s*.
Needle, B. Date, February 23, 1854. *Hour of beginning,* 3*h*. 50*m*. *p. m.; hour of ending,* 4*h*. 20*m*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	60	10	
	60	08	
	60	05	
Needle vertical, face of circle south, reading of azimuth circle	60	10	
	60	10	
	60	11	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	60	09	00
Reading of azimuth circle when plane of instrument is in the true meridian	74	00	21
Approximate magnetic declination	13	51	21 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 20	94 25	26 15	76	102 33	17 50	76
	60 20	94 20	26 22	------	102 25	17 55	------
	60 22	94 25	26 20	------	102 30	17 50	------
West	60 18	94 30	26 15	------	102 25	17 40	------
	60 25	94 25	26 20	------	102 35	17 45	------
	60 20	94 20	26 15	76	102 25	17 50	76
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	60 20 50	(1) 94 24 10		76	(1) 102 28 50		76
		(2) 26 17 50			(2) 17 48 20		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 29 38						
		° ′ ″			° ′ ″		
Differences	------	68 06 20		------	84 40 30		------
		° ′ ′			° ′ ″		
Half diff. or angles of deflection	------	34 03 10		------	42 20 15		------
		° ′ ″			° ′ ″		
Sum of means	------	120 42 00		------	120 17 10		------
		° ′ ″			° ′ ″		
Half sum = dip	------	60 21 00		------	60 08 35		------

OBSERVATIONS—Continued.

Station, Camp 132, *Rio Colorado; latitude* 34° 45′ 53″.60 *; longitude* 7*h.* 37*m.* 31. 23*s.*
Needle, B. Date, February 25, 1854. *Hour of beginning,* 2*h.* 50*m. p. m.; hour of ending,* 3*h.* 10*m. p. m.*
Observer, Lieut J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	19	30	
	19	28	
	19	20	
Needle vertical, face of circle south, reading of azimuth circle	19	20	
	19	30	
	19	30	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	19	28	00
Reading of azimuth circle when plane of instrument is in the true meridian	33	03	41
Approximate magnetic declination	13	35	41 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 40	94 35	26 25	76	102 45	18 22	76
	60 38	94 30	26 30	------	102 43	18 25	------
	60 42	94 40	26 30	------	102 40	18 28	------
West	60 37	94 30	26 20	------	102 35	18 20	------
	60 37	94 40	26 15	------	102 40	18 20	------
	60 40	94 38	26 18	76	102 30	18 17	76
	° ′ ″			°			°
Means	60 39 00	(1) 94 35 30		76	(1) 102 38 50		76
		(2) 26 23 00			(2) 18 22 00		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 47 48						
		° ′ ″			° ′ ″		
Differences	------	68 12 30		------	84 16 50		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	34 06 15		------	42 08 25		------
		° ′ ″			° ′ ″		
Sum of means	------	120 58 30		------	121 00 50		------
		° ′ ″			° ′ ″		
Half sum = dip	------	60 29 15		------	60 30 25		------

OBSERVATIONS—Continued.

Station, Camp 135, *Rio Colorado; latitude* 34° 52′ 15″.60; *longitude* 7*h.* 38*m.* 06.88*s.*
Needle, B. Date, March 1, 1854. *Hour of beginning,* 4*h.* 40*m. p. m.; hour of ending,* 5*h.* 05*m. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	
Needle vertical, face of circle north, reading of azimuth circle	83	25	
	83	30	
	83	20	
Needle vertical, face of circle south, reading of azimuth circle	83	25	
	83	15	
	83	22	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	83	22	50
Reading of azimuth circle when plane of instrument is in the true meridian	97	18	43
Approximate magnetic declination	13	55	53 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 45	94 35	26 40	61	102 32	18 20	61
	60 50	94 35	26 50	------	102 40	18 25	------
	60 50	94 25	26 45	------	102 30	18 22	------
West	60 50	94 40	26 50	------	102 32	18 28	------
	60 47	94 30	26 47	------	102 40	18 32	------
	60 48	94 30	26 50	57	102 37	18 37	57
	° ′ ″	° ′ ″		°	° ′ ″		
Means	60 48 20	(1) 94 32 30		59	(1) 102 35 10		------
		(2) 26 47 00			(2) 18 27 20		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 57 08						
		° ′ ″			° ′ ″		
Differences	------	67 45 30		------	84 07 50		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	33 52 45		------	42 03 55		------
		° ′ ″			° ′ ″		
Sum of means	------	121 19 30		------	121 02 30		------
		° ′ ″			° ′ ″		
Half sum = dip	------	60 39 45		------	60 31 15		------

OBSERVATIONS—Continued.

Station, Camp 135. *Date, March* 1, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. m. s.	° ′	° ′ ″	° ′ ″
West	Direct	8 38 37.9	8 40	1 36 57	7 03 03
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct				
	Direct	8 41 43.6	9 12	1 37 37	7 34 23
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					7 18 43

Error of chronometer + 3*h*. 17*m*. 55.2*s*.

Station, Camp 137. *Date, March* 3, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h m. s.	° ′	° ′ ″	° ′ ″
West.	Direct	8 42 54.5	66 35	1 37 53	64 57 07
	Direct				
	Reflection.				
	Reflection.				
East.	Reflection.				
	Reflection.				
	Direct				
	Direct	8 47 13.4	67 04	1 38 42	65 25 18
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					65 11 12

Error of chronometer + 3*h*. 19*m*. 53.08*s*.

OBSERVATIONS—Continued.

Station, *Camp* 137, *Pai-ute Creek*; *latitude* 35° 06′ 26″.10; *longitude* 7*h*. 39*m*. 35.06*s*.
Needle, *B*. *Date*, *March* 3, 1854. *Hour of beginning*, 4*h*. 20*m*. *p*. *m*.; *hour of ending*, 5*h*. *p*. *m*.
Observer, *Lieut*. *J*. *C*. *Ives*, *Topographical Engineers*.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	50	52		
	50	52		
	50	55		
Needle vertical, face of circle south, reading of azimuth circle	50	56		
	50	60		
	50	53		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	50	54	40	
Reading of azimuth circle when plane of instrument is in the true meridian	65	11	12	
Approximate magnetic declination	14	16	32	E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	61 00	94 42	26 53	58	102 55	18 43	------
	61 00	94 40	26 48	------	102 50	18 40	------
	61 03	94 40	26 55	------	102 53	18 50	------
West	61 03	94 48	26 60	------	102 50	18 43	------
	61 01	94 50	26 50	------	102 45	18 50	------
	61 00	94 50	26 55	58	102 40	18 40	54
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	61 01 10	(1) 94 45 00		58	(1) 102 48 50		54
		(2) 26 53 30			(2) 18 44 20		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 09 58						
		° ′ ″			° ′ ″		
Differences	------	67 51 30		------	84 04 30		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	33 55 45		------	42 02 15		------
		° ′ ″			° ′ ″		
Sum of means	------	121 38 30		------	121 33 10		------
		° ′ ″			° ′ ″		
Half sum = dip	------	60 49 15		------	60 46 35		------

OBSERVATIONS—Continued.

Station, Camp 140, *near Marl Springs; latitude* 35° 11′ 8″. 0; *longitude* 7*h*. 42*m*. 10. 30*s*.
Needle, B. Date, March 6, 1854. *Hour of beginning,* 4*h*. 15*m*. *p. m.; hour of ending,* 4*h*. 45*m*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	82	05	
	82	05	
	82	02	
Needle vertical, face of circle south, reading of azimuth circle	82	00	
	82	02	
	82	02	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	82	02	40
Reading of azimuth circle when plane of instrument is in the true meridian	96	01	45
Approximate magnetic declination	13	59	05 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 46	94 50	26 30	51	102 55	18 20	54
	60 47	94 45	26 28	------	102 48	18 20	------
	60 45	94 45	26 30	------	102 58	18 15	------
West	60 47	94 40	26 28	------	102 45	18 22	------
	60 50	94 38	26 30	------	102 55	18 15	------
	60 47	94 40	26 35	51	102 40	18 10	54
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	60 47 00	(1) 94 43 00		57	(1) 102 50 10		54
		(2) 26 30 10			(2) 18 17 00		
	′ ″						
Corr. for index error of needle	8 48						
	° ′ ″						
Deduced inclination	60 55 48						
		° ′ ″			° ′ ″		
Differences	------	68 12 50		------	84 33 10		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	34 06 25		------	42 16 35		------
		° ′ ″			° ′ ″		
Sum of means	------	121 13 10		------	121 07 10		------
		° ′ ″			° ′ ″		
Half sum = dip.	------	60 36 35		------	60 33 35		------

OBSERVATIONS—Continued.

Station, Camp 140. *Date, March* 6, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	9 11 35.9	97 30	1 42 36	95 47 24
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct				
	Direct	9 13 32.2	97 59	1 42 54	96 16 06
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					96 01 45

Error of chronometer + 3*h*. 22*m*. 55.3*s*.

Station, Camp 142. *Date, March* 8, 1854.

OBSERVATIONS ON POLARIS.

Face of circle.	Whether observations are direct or by reflection.	Time of observation by chronometer No. 10.	Reading of azimuth circle.	Computed azimuth of Polaris.	Reading of azimuth circle when plane of instrument is in the true meridian.
		h. *m.* *s.*	° ′	° ′ ″	° ′ ″
West	Direct	9 11 57.5	60 55	1 41 53	59 13 07
	Direct				
	Reflection				
	Reflection				
East	Reflection				
	Reflection				
	Direct				
	Direct	9 10 26.5	61 22	1 41 29	59 40 31
Reading of azimuth circle when plane of instrument is in the true meridian, by mean of two observations					59 26 59

Error of chronometer + 3*h*. 25*m*. 05.5*s*.

OBSERVATIONS—Continued.

Station, Camp 141, *Sand Camp; latitude* 35° 05′ 36″.25; *longitude* 7*h.* 43*m.* 03.13*s.*
Needle, B. Date, March 7, 1854. *Hour of beginning,* 4*h.* 30*m. p. m.; hour of ending,* 5*h. p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

Needle vertical, face of circle north, reading of azimuth circle	74	52	
	74	55	
	74	55	
Needle vertical, face of circle south, reading of azimuth circle	74	50	
	74	57	
	74	53	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	74	53	40
Reading of azimuth circle when plane of instrument is in the true meridian			
Approximate magnetic declination			

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. $2\frac{1}{2}$ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′ ″	° ′	° ′	°	° ′	° ′	°
East	60 38	94 30	26 33	58	102 30	18 18	60
	60 42	94 28	26 38	----	102 35	18 16	----
	60 42	94 35	26 33	----	102 30	18 22	----
West	60 40	94 40	26 38	----	102 30	18 15	----
	60 42	94 38	26 40	----	102 30	18 20	----
	60 38	94 35	26 38	58	102 33	18 18	60
	° ′ ″		° ′ ″	°		° ′ ″	°
Means	60 40 20	(1)	94 34 20	58	(1)	102 31 20	60
		(2)	26 36 40		(2)	18 18 10	
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	60 49 08						
		° ′ ″			° ′ ″		
Differences	----	67 57 40		----	84 13 10		----
		° ′ ″			° ′ ″		
Half. diff. or angles of deflection	----	33 58 50		----	42 06 35		----
		° ′ ″			° ′ ″		
Sum of means	----	121 11 00		----	120 49 30		----
		° ′ ″			° ′ ″		
Half sum = dip	----	60 35 30		----	60 24 45		----

Night cloudy; no observation for declination.

OBSERVATIONS—Continued.

Station, Camp 142, *Soda Lake; latitude* 35° 03′ 13″.20; *longitude* 7*h*. 43*m*. 55.06*s*.
Needle, B. Date, March 8, 1854. *Hour of beginning,* 4*h*. 50*m*. *p. m.; hour of ending,* 5*h*. 20*m*. *p. m.*
Observer, Lieut. J. C. Ives, Topographical Engineers.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	45	40	
	45	40	
	45	30	
Needle vertical, face of circle south, reading of azimuth circle	45	20	
	45	45	
	45	40	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	45	35	50
Reading of azimuth circle when plane of instrument is in the true meridian	59	26	49
Approximate magnetic declination	13	50	59 E.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fahr.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Fah. Ther.
	° ′	° ′	° ′	°	° ′	° ′	°
East	60 55	94 35	26 50	71	102 50	18 35	71
	60 60	94 42	26 50	------	102 50	18 38	------
	60 58	94 43	26 48	------	102 48	18 33	------
West	60 58	94 35	26 40	------	102 50	18 22	------
	60 59	94 45	26 50	------	102 45	18 30	------
	60 58	94 40	26 40	71	102 50	18 30	71
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	60 58 00	(1) 94 40 00		71	(1) 102 48 50		71
		(2) 26 46 20			(2) 18 31 20		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	61 06 48						
		° ′ ″		------	° ′ ″		------
Differences	------	67 53 40			84 17 30		
		° ′ ″			° ′ ″		------
Half diff. or angles of deflection	------	33 56 50		------	42 08 45		
		° ′ ″			° ′ ″		
Sum of means	------	121 26 20		------	121 20 10		------
		° ′ ″			° ′ ″		
Half sum = dip	------	60 43 10		------	60 40 05		------

OBSERVATIONS—Continued.

Station, Cambridge Observatory, Mass.; latitude 42° 22′ 48″; *longitude* 4*h*. 44*h*. 29. 6*s*.
Needle, B. Date, May 10, 1854. *Hour of beginning,* 10*h*. *a. m.; hour of ending,* 11*h*. *a. m.*
Observers, Professor W. C. Bond and Lieut. J. C. Ives.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	14	48		
	14	48		
	14	55		
Needle vertical, face of circle south, reading of azimuth circle	14	47		
	14	52		
	14	46		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	14	49	20	
Reading of azimuth circle when plane of instrument is in the true meridian	5	04		
Approximate magnetic declination	9	45	20	W.

ORSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 2.

Face of circle	Direct.	Def. N. 40° from dip. at 34 25	Def. N. 40° from dip. at 114 25	Def. S. 40° from dip. at 34 25	Def. S. 40° from dip. at 114 25	Results.		
East	° ′	° ′	° ′	° ′	° ′		° ′ ″	
	74 28	90 45	57 45	91 40	56 45		74 24 50	Direct.
	74 25	90 55	57 48	91 45	56 40			
	74 21	90 50	57 50	91 40	56 45			
						N.	74 17 55	By deflectors.
						S.	74 15 40	
West	74 22	90 40	57 50	91 45	56 55			
	74 28	90 45	57 50	91 40	56 50			
	74 25	90 45	57 52	91 48	56 55			
Means	° ′ ″	° ′ ″		° ′ ″			° ′ ″	
	74 24 50	90 46 40		91 43 00			74 19 28	Mean.
		57 49 10		56 48 20				
Sum of means		° ′ ″		° ′ ″				
		148 35 50		148 31 20				
Half sum = dip		° ′ ″		° ′ ″				
		74 17 55		74 15 40			+ 8 48	Corrections. Index error.
Differences		° ′ ″		° ′ ″				
		32 57 30		34 54 40				
Half diff. = angles of deflection		° ′ ″		° ′ ″			° ′ ″	
		16 28 45		17 27 20			74 28 16	True inclination.

OBSERVATIONS—Continued.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29. 6*s*.
Needle, B. Date, May 10, 1854. *Hour of beginning,* 11*h*. *a. m.*; *hour of ending,* 11*h*. 30*m*. *a. m.*
Observers, Professor W. C. Bond and Lieut. J. C. Ives.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	14	48		
	14	48		
	14	55		
Needle vertical, face of circle south, reading of azimuth circle	14	47		
	14	52		
	14	46		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	14	49	20	
Reading of azimuth circle when plane of instrument is in the true meridian	5	04		
Approximate magnetic declination	9	45	20	W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 2.

Face of circle.	Direct.	N. P. needle A 40° from dip. at 34 25	N. P. needle A 40° from dip. at 114 25	S. P. needle A 40° from dip. at 34 25	S. P. needle A 40° from dip. at 114 25	Results.		
East	° ′	° ′	° ′	° ′	° ′		° ′ ″	
	74 28	95 40	53 20	95 12	52 48		74 24 50	Direct.
	74 25	95 38	53 15	95 20	52 55			
	74 21	95 35	53 15	95 20	52 58			
						N.	74 22 45	By deflectors.
						S.	74 15 55	
West	74 22	95 35	53 05	95 40	53 10			
	74 28	95 30	53 00	95 40	53 08			
	74 25	95 30	53 10	95 45	53 15			
Means	° ′ ″	° ′ ″		° ′ ″			° ′ ″	
	74 24 50	95 34 40		95 29 30			74 21 10	Mean.
		53 10 50		53 02 20				
Sum of means		° ′ ″		° ′ ″				
		148 45 30		148 31 50				
Half sum = dip		° ′ ″		° ′ ″				
		74 22 45		74 15 55			+ 8 48	Corrections. Index error.
Differences		° ′ ″		° ′ ″				
		42 24 50		42 27 10				
Half diff. = angles of deflection		° ′ ″		° ′ ″			° ′ ″	
		21 12 25		21 13 35			74 29 58	True inclination.

OBSERVATIONS—Continued.

Station, Cambridge Observatory ; latitude 42° 22′ 48″ *; longitude* 4*h.* 44*m.* 29.6*s.*
Needle, A. Date, May 10. 1854. *Hour of beginning,* 11*h.* 30*m. a. m. ; hour of ending,* 12 *m.*
Observers, Prof. W. C. Bond and Lieut. J. C. Ives.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	14	52	
	14	50	
	14	45	
Needle vertical, face of circle south, reading of azimuth circle	14	52	
	14	50	
	14	60	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	14	51	30
Reading of azimuth circle when plane of instrument is in the true meridian	5	04	00
Approximate magnetic declination	9	47	30 W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 2.

Face of circle.	Direct.	Def. N. 40° from dip. at 34 25	Def. N. 40° from dip. at 114 25	Def. S. 40° from dip. at 34 25	Def. S. 40° from dip. at 114 25	Results.	
	° ′	° ′	° ′	° ′	° ′	° ′ ″	
East	74 35	90 30	58 15	91 58	56 55		
	74 35	90 20	58 20	91 60	56 50	74 30 30	Direct.
	74 30	90 30	58 25	91 57	56 48		
						N. 74 21 25	By deflectors.
						S. 74 20 05	
West	74 30	90 20	58 15	91 55	56 30		
	74 28	90 22	58 25	91 58	56 40		
	74 25	90 15	58 20	91 52	56 38		
	° ′ ″	° ′ ″		° ′ ″		° ′ ″	
Means	74 30 30	90 22 50		91 56 40		74 24 03	Mean.
		58 20 00		56 43 30			
		° ′ ″		° ′ ″			
Sum of means		148 42 50		148 40 10		+ 15 04	Corrections. Index error.
		° ′ ″		° ′ ″			
Half sum = dip		74 21 25		74 20 05			
		° ′ ″		° ′ ″			
Differences		32 02 50		35 13 10			
		° ′ ″		° ′ ″		° ′ ″	
Half diff. = angles of deflection		16 01 25		17 36 35		74 39 07	True inclination.

OBSERVATIONS—Continued.

Station, Cambridge Observatory ; latitude 42° 22′ 48″ *; longitude* 4*h.* 44*m.* 29. 6*s.*
Needle, A. Date, May 10, 1854. *Hour of beginning,* 12*h. m. ; hour of ending,* 12*h.* 30*m. p. m.*
Observers, Prof. W. C. Bond and Lieut. J. C. Ives.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	14	52	
	14	50	
	14	45	
Needle vertical, face of circle south, reading of azimuth circle	14	52	
	14	50	
	14	60	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	14	51	30
Reading of azimuth circle when plane of instrument is in the true meridian	5	04	00
Approximate magnetic declination	9	47	30 W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 2.

Face of circle.	Direct.	N. P. needle B 40° from dip.		S. P. needle B 40° from dip.		Results.	
		at 34 25	at 114 25	at 34 25	at 114 25		
	° ′	° ′	° ′	° ′	° ′	° ′ ″	
East	74 35	96 50	51 45	94 50	53 45		
	74 35	96 48	51 48	94 48	53 40	74 30 30	Direct.
	74 30	96 58	51 45	94 55	53 40		
						N. 74 12 40	By deflectors.
						S. 74 14 40	
West	74 30	96 25	51 50	94 38	53 50		
	74 28	96 25	51 50	94 40	53 40		
	74 25	96 20	51 48	94 50	53 40		
	° ′ ″	° ′ ″		° ′ ″		° ′ ″	
Means	74 30 30	96 37 40		94 46 50		74 19 17	Mean.
		51 47 40		53 42 30			
		° ′ ″		° ′ ″			Corrections.
Sum of means		148 25 20		148 29 20		+ 15 04	Index error.
		° ′ ″		° ′ ″			
Half sum = dip		74 12 40		74 14 40			
		° ′ ″		° ′ ″			
Differences		44 57 00		41 04 20			
		° ′ ″		° ′ ″		° ′ ′	
Half diff. = angles of deflection		22 28 30		20 32 10		74 34 21	True inclination.

OBSERVATIONS—Continued.

Station, Cambridge Observatory ; latitude 42° 22′ 48″ *; longitude* 4*h.* 44*m.* 29.6*s.*
Needle, B. Date, May 10, 1854. *Hour of beginning,* 1*h. p. m.; hour of ending,* 1*h.* 20*m. p. m.*
Observers, Prof. W. C. Bond and Lieut. J. C. Ives.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	14	48		
	14	48		
	14	55		
Needle vertical, face of circle south, reading of azimuth circle	14	47		
	14	52		
	14	46		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	14	49	20	
Reading of azimuth circle when plane of instrument is in the true meridian	5	04	00	
Approximate magnetic declination	9	45	20	W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. $2\frac{1}{2}$ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	74 28	104 40	43 40	70	111 40	36 32	70
	74 25	104 45	43 45	------	111 35	36 35	------
	74 21	104 50	43 45	------	111 33	36 30	------
West	74 22	104 45	43 50	------	111 55	36 35	------
	74 28	104 40	43 55	------	111 50	36 32	------
	74 25	104 42	43 50	70	111 50	36 30	70
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	74 24 50	(1) 104 43 40		70	(1) 111 43 50		70
		(2) 43 47 30			(2) 36 32 20		
	′ ″						
Cor. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	74 33 38						
		° ′ ″			° ′ ″		
Differences	------	60 56 10		------	75 11 30		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	30 28 05		------	37 35 45		------
		° ′ ″			° ′ ″		
Sum of means	------	148 31 10		------	148 16 10		------
		° ′ ″			° ′ ″		
Half sum = dip	------	74 15 35		------	74 08 05		------

OBSERVATIONS—Continued.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h.* 44*m.* 29.6*s.*
Needle, B. Date, May 10, 1854. *Hour of beginning,* 12*h.* 30*m. p. m.; hour of ending,* 1*h. p. m.*
Observers, Prof. W. C. Bond and Lieut. J. C. Ives.

	°	′	″
Needle vertical, face of circle north, reading of azimuth circle	14	48	
	14	48	
	14	55	
Needle vertical, face of circle south, reading of azimuth circle	14	47	
	14	52	
	14	46	
Reading of azimuth circle when plane of instrument is in the magnetic meridian	14	49	20
Reading of azimuth circle when plane of instrument is in the true meridian	5	04	00
Approximate magnetic declination	9	45	20 W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 3.

Face of circle.	Direct.	Def. S. at app. dip. 74° 24′ 50″.			Def. N. at app. dip. 74° 24′ 50″.		
		Def. towards the vertical.	Def. from the the vertical.	Ther. Fah.	Def. towards the vertical.	Def. from the the vertical.	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	74 28	106 55	41 65	70	104 45	43 50	70
	74 25	106 50	41 70	------	104 50	43 50	------
	74 21	106 55	41 60	------	104 55	43 45	------
West	74 22	106 40	41 40	------	104 45	43 55	------
	74 28	106 48	41 45	------	104 48	43 55	------
	74 25	106 45	41 50	70	104 50	43 50	70
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	74 24 50	{ 106 48 50 } { 41 55 00 }		70	{ 104 48 50 } { 43 50 50 }		70
	′ ″						
Corr. for index error of needle	+ 8 48						
	° ′ ″						
Deduced inclination	74 33 38						
		° ′ ″			° ′ ″		
Sum of means	------	148 43 50		------	148 39 40		------
		° ′ ″			° ′ ″		
Half sum = dip	------	74 21 55		------	74 19 50		------
		° ′ ″			° ′ ″		
Diff. of means	------	64 53 50		------	60 58 00		------
		° ′ ″			° ′ ″		
Half diff. = angles of deflection	------	32 26 55		------	30 29 00		------

OBSERVATIONS—Continued.

Station, Cmmbridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29. 6*s*.
Needle, A. Date, May 10, 1854. *Hour of beginning,* 1*h*. 20*m p. m.*; *hour of ending,* 1*h*. 50*m. p. m.*
Observers, Prof. W. C. Bond and Lieut. J. C. Ives.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	14	52		
	14	50		
	14	45		
Needle vertical, face of circle south, reading of azimuth circle	14	52		
	14	50		
	14	60		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	14	51	30	
Reading of azimuth circle when plane of instrument is in the true meridian	5	04		
Approximate magnetic declination	9	47	30	W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 3.

Face of circle.	Direct.	Def. S. at app. dip.			Def. N. at app. dip.		
		Def. towards the vertical.	Def. from the vertical.	Ther. Fah.	Def. towards the vertical.	Def. from the vertical.	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ″	°
East	74 35	107 30	41 05	72	103 45	44 55	72
	74 35	107 30	41 10	------	103 43	44 58	------
	74 30	107 28	41 12	------	103 40	44 55	------
West	74 30	107 25	41 15	------	103 30	44 50	------
	74 28	107 32	41 25	------	103 40	44 55	------
	74 25	107 30	41 20	72	103 38	44 50	72
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	74 30 30	107 29 10		72	103 39 20		72
		41 14 30			44 53 50		
	′ ″						
Cor. for index error of needle	+ 15 04						
	° ′ ″						
Deduced inclination	74 45 34						
		° ′ ″			° ′ ″		
Diff. of means	------	66 14 40		------	58 45 30		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	33 07 50		------	29 22 45		------
		° ′ ″			° ′ ″		
Sum of means	------	148 43 40		------	148 33 10		------
		° ′ ″			° ′ ″		
Half sum = dip	------	74 21 50		------	74 16 35		------

OBSERVATIONS—Continued.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h.* 44*m.* 29.6*s.*
Needle, A. Date, May 10, 1854. *Hour of beginning,* 1*h.* 50*m. p. m.; hour of ending,* 2*h.* 10*m. p. m.*
Observers, Prof. W. C. Bond and Lieut. J. C. Ives.

	°	′	″	
Needle vertical, face of circle north, reading of azimuth circle	14	52		
	14	50		
	14	45		
Needle vertical, face of circle south, reading of azimuth circle	14	52		
	14	50		
	14	60		
Reading of azimuth circle when plane of instrument is in the magnetic meridian	14	51	30	
Reading of azimuth circle when plane of instrument is in the true meridian	5	04	00	
Approximate magnetic declination	9	47	30	W.

OBSERVATIONS FOR MAGNETIC INCLINATION AND INTENSITY—No. 4.

Face of circle.	Direct.	Def. with wt. 2½ gr.			Def. with wt. 3 gr.		
		Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.	Def. towards the vertical. (1)	Def. from the vertical. (2)	Ther. Fah.
	° ′	° ′	° ′	°	° ′	° ′	°
East	74 35	104 38	43 45	72	111 35	36 45	72
	74 35	104 40	43 45	------	111 30	36 40	------
	74 30	104 45	43 50	------	111 37	36 50	------
West	74 30	104 35	43 45	------	111 18	36 55	------
	74 28	104 25	43 45	------	111 30	36 45	------
	74 25	104 20	43 55	72	111 20	36 52	72
	° ′ ″	° ′ ″		°	° ′ ″		°
Means	74 30 30	(1) 104 33 50		72	(1) 111 28 20		72
		(2) 43 47 30			(2) 36 47 50		
	′ ″						
Corr. for index error of needle	+ 15 04						
	° ′ ″						
Deduced inclination	74 45 34						
		° ′ ″			° ′ ″		
Differences	------	60 46 20		------	74 40 30		------
		° ′ ″			° ′ ″		
Half diff. or angles of deflection	------	30 23 10		------	37 20 15		------
		° ′ ″			° ′ ″		
Sum of means	------	148 21 20		------	148 16 10		------
		° ′ ″			° ′ ″		
Half sum = dip	------	74 10 40		------	74 08 05		------

Station, Cambridge Observatory. Date, May 10, 1854.

		°	′
Reading of azimuth circle when plane of instrument is in the true meridian	Face west	5	07
	Face east	5	01
Mean		5	04

OBSERVATIONS—Continued.

MAGNETIC DECLINATION AND INDEX ERROR OF NEEDLES.

Station, Albuquerque; latitude 35° 05′ 50″; *longitude* 7*h*. 06*m*. 31. 47*s*.

Date.	Needle.	No. of observations.	Magnetic declination.	Index error of needle.	Remarks.
1853.			° ′ ″	′ ″	
October 17	C	12	13 23 14		Poles reversed.
October 20	C	12	13 25 56		Poles reversed.
October 18	A	6	13 13 21	+ 11 14	
October 19	A	6	13 24 31	+ 4	
October 21	B	6	13 22 41	+ 1 54	

Station, Cambridge Observatory; *latitude* 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29. 6*s*.

1850.			° ′ ″	′ ″	
August 9	C	6	9 30 15		
August 9	A	6	9 41 25	— 11 10	
August 9	B	6	9 30 45	— 30	

MAGNETIC INCLINATION AND INDEX ERROR OF NEEDLES.

Station, Cambridge Observatory; latitude 42° 22′ 48″; *longitude* 4*h*. 44*m*. 29. 6.

Date.	Needle.	Hour.	Ther. Fah.	No. of observations.	Inclination.	Index error of needle.	Remarks.
1850.			°		° ′ ″	′ ″	
August 9	C	11 a. m	75	12	74 33 50		Poles reversed.
August 9	A	4 p. m	75	6	74 23 00	+ 10 50	
August 9	A	1 p. m	75	6	74 18 48	+ 15 02	
August 9	A	4 30 p. m	75	6	74 19 20	+ 14 30	
August 9	B	6 p. m	75	6	74 22 00	+ 11 50	
August 9	B	6 30 p. m	75	6	74 25 50	+ 8 00	

Station, Albuquerque; latitude 35° 05′ 50″; *longitude* 7*h*. 06*m*. 31. 47*s*.

1853.			°		° ′ ″	′ ″	
October 17	C	2 p. m	76	12	62 30 50		Poles reversed.
October 20	C	5 p. m	74	12	62 25 35		Poles reversed.
October 18	A	1 p. m	75	6	62 11 40	+ 16 32	
October 18	A	2 p. m	75	6	62 14 30	+ 13 42	
October 19	A	11 a. m	73	6	62 08 25	+ 19 47	
October 21	B	12 m	73	6	62 20 20	+ 7 52	
October 21	B	1 30 p. m	73	6	62 18 10	+ 10 02	

Station, Zuñi; latitude 35° 07′ 04″.49; *longitude* 7*h*. 13*m*. 16. 44*s*.

Date.	Needle.	Hour.	Ther. Fah.	No. of observation.	Inclination.	Index error of needle.	Remarks.
1853.			°		° ′ ″	′ ″	
November 22	C	1 p. m	76	12	62 01 47		Poles reversed.
November 21	B	3 p. m	74	6	61 55 30	+ 6 17	

OBSERVATIONS—Continued.

RESULTS FOR INDEX ERRORS OF NEEDLES.

Station.	Index error of needle A.	Index error of needle B.
	′ ″	′ ″
Cambridge Observatory	+ 15 02	+ 11 50
Cambridge Observatory	+ 10 50	+ 8 00
Cambridge Observatory	+ 14 30	
Albuquerque	+ 16 32	+ 7 52
Albuquerque	+ 13 42	+ 10 02
Albuquerque	+ 19 47	
Zuñi		+ 6 17
Means	+ 15 04	+ 8 48

INCLINATION AT CAMBRIDGE OBSERVATORY, MAY 10, 1854.

	°	′	″
Needle A, with deflectors	74	28	16
Needle A, with deflectors	74	39	07
Needle B, with deflectors	74	29	58
Needle A, with deflectors	74	34	21
Needle B, direct	74	31	00
Needle A, direct	74	38	02
Mean inclination	74	33	27

APPENDIX F.

MAGNETIC INTENSITY.

The following extracts from a letter received from Professor W. C. Bond, Director of Harvard College Observatory, contains important data for the determination of our magnetic results:

HARVARD COLLEGE OBSERVATORY,
Cambridge, January 2, 1855.

MY DEAR SIR: * * * * * * * * * *

The total intensity at Cambridge, in 1842, was 1.777, and the change from year to year is probably very small.

The details of the observations made with your instrument at Cambridge, in December and January, 1844–5, by Colonel Graham and myself, are in the possession of the former. I find only the following memoranda:

MAGNETIC RESULTS.

December 30, 1844.—Temperature,		39°.5	; needle,	B	; weight,	3.0	grs. ; intensity,		1.2960
"	"	39°.5	"	B	"	3.5	"		1.2960
"	"	39°.5	"	A	"	3.0	"		1.2900
"	"	39°.5	"	A	"	3.5	"		1.2890
Mean by both deflectors.....									1.3014
January 2, 1845.—Temperature,		36°	; needle,	A	; weight,	3.5	grs. ; intensity,		1.2870
"	"	36°	"	C	"	2.5	"		1.2940
"	"	36°	"	C	"	3.0	"		1.2980
January 3, 1845.	"	19°	"	C	"	2.5	"		1.3010
"	"	19°	"	C	"	3.0	"		1.3020
"	"	26°	"	C	"	3.5	"		1.3120

The foregoing results are given uncorrected for temperature changes.

Mr. Fox obtained at Falmouth, England, in September, 1844, with the same needles, at temperature of 60° Fahrenheit—Fox, 1.000; = 1.374 Sabine.

It will be necessary, in case of differences occurring in the determination of the intensity at different years, between 1844 and 1854, to suppose a uniform change in the *needles*.

To convert Mr. Fox's unit to Colonel Sabine's, multiply the former by 1.374. Thus, total intensity at Cambridge: Fox, $1.293 \times 1.374 = 1.777$ Sabine.

MAGNETIC DIP AT CAMBRIDGE.

1840	74° 21′
1844	74° 18′
1849	74° 24′

DECLINATION.

1840	9° 18′ W.
1844	9° 39′ W.
1852	10° 08′ W.
1854	10° 39′ W.

With much esteem, I remain, dear sir, yours truly,

W. C. BOND.

Lieut. A. W. WHIPPLE,
Topographical Engineers, Washington.

The total intensity at Cambridge, May 4, 1842, was reported to be, by Sabine's unit, 1.7982; which number is used as the standard of comparison in the following table.

Supposing the weights that are used, and the magnetism of the needles, both to remain constant, the intensities of the earth's magnetic force in different localities are inversely as the signs of the angles of deflection at those places.

By the observations made at Cambridge, in 1850 and 1854, it is found that the magnetism of the needles suffered a change between those dates, and a correction has been made upon the principle that the diminution in intensity progressed at a uniform rate.

Computation of Observations for Magnetic Intensity at forty-six stations upon the Pacific Railroad Survey, near the parallel of thirty-five degrees north latitude.

Station.	Date.	Place for comparison.	Needle	Deflector.	Angles of deflection.				Intensity at place for comparison by Sabine's unit.	Results for intensity at station.	Mean result for intensity at station by Sabine's unit.
					At Cambridge observatory, August 9, 1850.	At Cambridge observatory, May 10, 1854.	Deduced for comparison at date.	Observed at station.			
	1853.				° ′ ″	° ′ ″	° ′ ″	° ′ ″			
Albuquerque, N. M.	Oct. 19	Cambridge	A	S. (at App. Dip.)	34 05 40	33 07 50	33 16 24	34 51 50	1.7982	1.7279	
Do.	do	do	A	N. (at App. Dip.)	30 47 10	29 22 45	29 35 16	31 16 25		1.7106	
Do.	Oct. 21	do	B	N. (40° from Dip.)	17 09 50	16 28 45	16 34 47	17 37 30		1.6946	
Do.	do	do	B	S. (40° from Dip.)	18 04 50	17 27 20	17 32 50	18 43 10		1.6893	
Do.	Oct. 18	do	A	N. (40° from Dip.)	16 42 50	16 01 25	16 07 35	17 13 25		1.6868	
Do.	do	do	A	S. (40° from Dip.)	18 15 55	17 36 35	17 42 26.6	18 54 10		1.6882	1.6887
Do.	do	do	A	Wt. 2½ grains	29 56 05	30 23 10	30 19 08	32 32 00		1.6879	
Do.	Oct. 21	do	B	Wt. 3 do	36 57 16	37 35 45	37 30 06	40 22 35		1.6899	
Do.	do	Camp 83	B	Wt 2 do			26 13 20	25 50 05	1.6610	1.6842	
Isleta.	Nov. 9	Albuquerque	B	Wt. 2 do			25 43 50	25 46 20	1.6887	1.6861	1.6861
Rio Rita, Camp 63*	Nov. 12	Isleta.	B	Wt 1 do			12 38 50	12 37 25	1.6861	1.6892	
Covèra.	Nov. 14	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 23 50	32 40 25	1.7982	1.6854	
Covèra.	do	Albuquerque	B	Wt. 2 do			25 50 05	25 45 25	1.6887	1.6935	1.6894
Camp 65	Nov. 15	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 23 51	35 29 50	1.7982	1.5670	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	28 02 05	1.6887	1.5657	1.5663
Agua Fria	Nov. 17	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 23 54	32 45 15	1.7982	1.6818	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	25 46 10	1.6887	1.6927	1.6872
Inscription Rock	Nov. 18	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 03	32 48 10	1.7982	1.6797	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 01 00	1.6887	1.6777	1.6787
Camp 70, near Zuñi	Nov. 21	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	34 24 07	32 45 10	1.7982	1.6811	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	25 53 05	1.6887	1.6856	1.6833
Camp 71	Nov. 26	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 14	32 49 45	1.7982	1.6786	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	25 52 55	1.6887	1.6858	1.6822
Camp 72	Nov. 28	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 17	32 50 20	1.7982	1.6782	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	25 59 10	1.6887	1.6795	1.6788
Camp 73	Nov. 29	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 18	32 53 50	1.7982	1.6756	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 05 20	1.6887	1.6734	1.6745
Camp 74	Nov. 30	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 19	33 00 50	1.7982	1.6704	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	25 59 10	1.6887	1.6796	1.6750
Camp 75	Dec. 1	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 21	33 01 35	1.7982	1.6698	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 02 45	1.6887	1.6760	1.6729
Camp 76	Dec. 2	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 22	33 09 35	1.7982	1.6639	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 03 45	1.6887	1.6711	1.6675
Camp 77	Dec. 3	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 24	33 07 50	1.7982	1.6652	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 08 30	1.6887	1.6702	1.6677

* Observations at this station made only with face of instrument *west*.

COMPUTATION OF OBSERVATIONS FOR MAGNETIC INTENSITY—Continued.

Station.	Date.	Place for comparison.	Needle	Deflector.	Angles of deflection.				Intensity at place for comparison by Sabine's unit.	Results for intensity at station.	Mean result for intensity at station by Sabine's unit.
					At Cambridge observatory, August 9, 1850.	At Cambridge observatory, May 10, 1854.	Deduced for comparison at date.	Observed at station.			
	1853.				° ′ ″	° ′ ″	° ′ ″	° ′ ″			
Camp 78	Dec. 5	Cambridge	B	Wt. 2½ grains	29 55 15	30 28 05	30 24 26	33 01 55	1.7982	1.6697	1.6705
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 07 20	1.6887	1.6714	
Camp 80	Dec. 7	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 29	33 12 20	1.7982	1.6620	1.6652
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 10 25	1.6887	1.6684	
Camp 81	Dec. 8	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 24 31	33 16 35	1.7982	1.6589	1.6633
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 07 05	1.6887	1.6678	
Camp 83	Dec. 15	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 31 37	41 11 40	1.7982	1.6631	1.6625
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 24 41	33 16 40	1.7982	1.6589	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 13 20	1.6887	1.6655	
Camp 84	Dec. 16	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 31 39	41 02 45	1.7982	1.6686	1.6678
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 24 42	33 08 00	1.7982	1.6654	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 09 30	1.6887	1.6693	
Camp 85	Dec. 17	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 31 41	41 01 10	1.7982	1.6690	1.6673
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 24 43	33 10 05	1.7982	1.6638	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 09 40	1.6887	1.6691	
Camp 86	Dec. 18	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 31 42	40 49 20	1.7982	1.6756	1.6785
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 24 44	32 52 50	1.7982	1.6767	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	25 55 30	1.6887	1.6832	
Camp 91	Dec. 29	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 32 01	41 18 55	1.7982	1.6594	1.6591
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 24 59	33 17 00	1.7982	1.6589	
	1854.										
Camp 96	Jan. 9	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 32 19	40 59 15	1.7982	1.6704	1.6738
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 25 15	33 05 25	1.7982	1.6677	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	25 55 30	1.6887	1.6832	
Camp 103	Jan. 21	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 32 39	41 32 05	1.7982	1.6526	1.6522
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 25 32	33 28 15	1.7982	1.6512	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 26 55	1.6887	1.6527	
Camp 105	Jan. 23	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 32 42	41 43 15	1.7982	1.6466	1.6483
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 25 35	33 36 25	1.7982	1.6453	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 26 15	1.6887	1.6529	
Camp 108	Jan. 28	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 32 50	42 36 00	1.7982	1.6190	1.6184
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 25 42	34 23 30	1.7982	1.6123	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 56 50	1.6887	1.6239	
Camp 109	Jan. 30	Cambridge	B	Wt. 2½ do	29 55 15	30 28 05	30 25 45	33 22 50	1.7982	1.6553	1.6586
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 17 00	1.6887	1.6619	
Camp 111	Feb. 1	Cambridge	B	Wt. 3 do	36 57 16	37 35 45	37 32 55	41 45 25	1.7982	1.6455	1.6476
Do.	do	do	B	Wt. 2½ do	29 55 15	30 28 05	30 25 46	33 41 50	1.7982	1.6416	
Do.	do	Albuquerque	B	Wt. 2 do			25 50 05	26 23 05	1.6887	1.6558	

Camp 112	Feb. 4	Cambridge	B	Wt. 3	36 57 16	37 35 45	37 33 00	42 15 00	1.7982	1.6299	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 25 50	34 02 55	1.7982	1.6267	1.6311
Do.	do	Albuquerque	B	Wt. 2			25 50 05	26 43 15	1.6887	1.6366	
Camp 116	Feb. 8	Cambridge	B	Wt. 3	36 57 16	37 35 45	37 33 07	42 33 20	1.7982	1.6205	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 25 55	34 14 00	1.7982	1.6190	1.6220
Do.	do	Albuquerque	B	Wt. 2			25 50 05	26 54 00	1.6887	1.6265	
Camp 117	Feb. 9	Cambridge	B	Wt. 3	36 57 16	37 35 45	37 33 09	42 21 20	1.7982	1.6267	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 25 57	34 11 40	1.7982	1.6214	1.6275
Do.	do	Albuquerque	B	Wt. 2			25 50 05	26 45 40	1.6887	1.6343	
Camp 121	Feb. 13	Cambridge	B	Wt. 3	36 57 16	37 35 45	37 33 16	42 15 00	1.7982	1.6301	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 02	34 06 30	1.7982	1.6235	1.6311
Do.	do	Albuquerque	B	Wt. 2			25 50 05	26 40 00	1.6887	1.6397	
Camp 122	Feb. 15	Cambridge	B	Wt. 3	36 57 16	37 35 45	37 33 19	42 17 05	1.7982	1.6290	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 05	34 00 30	1.7982	1.6286	1,6288
Camp 123	Feb. 16	do	B	Wt. 3	36 57 16	37 35 45	37 33 21	42 25 50	1.7982	1.6245	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 06	34 07 20	1.7982	1.6238	1.6241
Rio Santa Maria	Feb. 20	do	B	Wt. 3	36 57 16	37 35 45	37 33 28	42 28 35	1.7982	1.6232	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 11	34 08 15	1.7982	1.6233	1.6232
Camp 128	Feb. 21	do	B	Wt. 3	36 57 16	37 35 45	37 33 30	42 17 05	1.7982	1.6291	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 12	34 08 40	1.7982	1.6230	1,6260
Camp 129	Feb. 22	do	B	Wt. 3	36 57 16	37 35 45	37 33 32	42 24 50	1.7982	1.6252	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 14	33 56 25	1.7982	1.6316	1.6284
Camp 130	Feb. 23	do	B	Wt. 3	36 57 16	37 35 45	37 33 33	42 20 15	1.7982	1.6275	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 15	34 03 10	1.7982	1.6268	1.6271
Camp 132	Feb. 25	do	B	Wt. 3	36 57 16	37 35 45	37 33 36	42 08 25	1.7982	1.6338	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 18	34 06 15	1.7982	1.6247	1.6292
Camp 135	March 1	do	B	Wt. 3	36 57 16	37 35 45	37 33 43	42 03 55	1.7982	1.6362	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 24	33 52 45	1.7982	1.6343	1.6352
Camp 137	March 3	do	B	Wt. 3	36 57 16	37 35 45	37 33 46	42 02 15	1.7982	1.6371	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 27	33 55 45	1.7982	1.6322	1.6346
Camp 140	March 6	do	B	Wt. 3	36 57 16	37 35 45	37 33 51	42 16 35	1.7982	1.6296	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 31	34 06 25	1.7982	1.6248	1.6272
Camp 141	March 7	do	B	Wt. 3	36 57 16	37 35 45	37 33 53	42 06 35	1.7982	1.6349	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 32	33 58 50	1.7982	1.6301	1.6325
Camp 142	March 8	do	B	Wt. 3	36 57 16	37 35 45	37 33 55	42 08 45	1.7982	1.6338	
Do.	do	do	B	Wt. 2½	29 55 15	30 28 05	30 26 34	33 56 50	1.7982	1.6316	1.6327

APPENDIX G.

Results of Observations near the parallel of 35° north latitude, between Rio del Norte, N. M., and the Pacific Ocean, for Magnetic Inclination, Declination, and Intensity.

No. for reference.	Date.	No. of camp.	Name of place.	Latitude north.	Longitude west of Greenwich.	Elevation above the sea, in feet.	Magnetic inclination.	Magnetic declination.	Total magnetic intensity by Col. Sabine's unit of measure.
	1850.			° ′ ″	° ′ ″		° ′ ″	W. of N. ° ′ ″	
1	Aug. 9	------	Cambridge Observ'y..	42 22 48.6	71 07 24.9	--------	74 33 50	9 30 15	1.7982
	1854.								
1	May 10	------	------ do- ----------	42 22 48.6	71 07 24.9	--------	74 33 37	9 46 25	1.7982
	1853.							E. of N.	
2	Oct. 17	59	Albuquerque - ------	35 05 50.80	106 37 52.05	5026.1	62 28 12	13 24 35	1.6887
3	Nov. 9	61	Isleta -------------	34 54 27.06	106 39 58.80	4909.6	62 24 28	13 13 25	1.6861
4	Nov. 12	63	Rio San José--------	35 01 09.91	107 14 17.70	5556.3	63 17 38	13 45 58	1.6892
5	Nov. 14	64	Covèra ------------	35 05 22.10	107 26 14.25	5879.8	62 26 28	13 49 18	1.6894
6	Nov. 15	65	Hay camp*---------	35 04 59.69	107 39 12.30	6080.9	35 39 08	35 56 09	1.5663
7	Nov. 17	67	Agua Fria----------	35 01 35.56	107 58 14.85	7757.1	62 04 58	13 25 32	1.6872
8	Nov. 18	68	Inscription Rock †---	35 02 40.86	108 14 18.15	7237.8	62 02 38	12 56 54	1.6787
9	Nov. 22	70	Zuñi river ----------	35 05 41.88	108 38 53.40	6336.5	62 01 47	13 23 34	1.6833
10	Nov. 26	71	Arch spring --------	35 04 45.10	108 47 35.85	6350.1	61 55 28	----------	1.6822
11	Nov. 28	72	Cedar forest--------	35 01 13.23	108 54 36.90	6162.2	61 40 18	13 01 23	1.6788
12	Nov. 29	73	Jacob's well --------	35 03 53.49	109 14 05.70	5973.4	61 59 38	13 43 41	1.6745
13	Nov. 30	74	Navajo spring-------	35 06 19.44	109 20 09.75	5665.5	61 57 58	13 23 19	1.6750
14	Dec. 1	75	Carriso creek--------	35 06 32.35	109 32 01.20	5550.1	62 05 08	13 53 41	1.6729
15	Dec. 2	76	Lithodendron creek--	35 02 07.83	109 40 48.90	5499.9	61 56 48	13 32 38	1.6675
16	Dec. 3	77	Rio Puerco of the West.	34 57 56.58	109 52 12.30	5110.6	61 46 08	14 00 05	1.6677
17	Dec. 5	78	Colorado Chiquito, or Flax river.	34 53 01.95	110 03 33.30	5015.7	62 15 18	13 42 22	1.6705
18	Dec. 7	80	On Colorado Chiquito, or Flax river.	34 59 39.19	110 25 09.00	4735.8	61 53 48	13 39 39	1.6652
19	Dec. 8	81	------do ----------	35 01 21.03	110 29 42.15	4760.9	61 40 38	13 20 51	1.6633
20	Dec. 15	83	------do ----------	35 05 18.26	110 33 01.35	4675.2	61 44 08	----------	1.6625
21	Dec. 16	84	------do ----------	35 12 02.77	110 37 24.60	4618.3	61 45 08	13 39 28	1.6678
22	Dec. 17	85	------do ----------	35 18 11.74	110 52 56.55	4594.3	61 55 18	13 41 39	1.6673
23	Dec. 18	86	------do ----------	35 20 54.12	110 56 19.50	4569.5	62 03 18	----------	1.6785
24	Dec. 29	91	Leroux's spring ----	35 16 48.77	111 39 32.70	7378.4	61 33 28	13 52 26	1.6591
	1854.								
25	Jan. 9	96	Cedar creek--------	35 20 35.09	112 19 34.05	5671.7	62 06 28	13 49 06	1.6738
26	Jan. 21	103	Pueblo creek--------	34 56 31.00	112 46 09.00	5203.5	61 12 58	13 59 24	1.6522
27	Jan. 23	105	Williams' river‡ ----	34 59 25.55	112 57 29.25	5751.7	61 05 58	14 48 06	1.6483
28	Jan. 28	108	------do ----------	35 06 34.30	113 12 41.25	4680.1	61 17 08	13 40 16	1.6184
29	Jan. 30	109	Near White Cliff creek.	35 12 26.50	113 21 21.75	4784.5	61 14 18	----------	1.6586
30	Feb. 1	111	White Cliff creek----	35 08 07.70	113 31 09.60	3526.1	60 47 58	14 42 25	1.6476
31	Feb. 4	112	Big Horn springs----	35 00 51.53	113 36 08.70	2783.9	61 01 48	14 17 57	1.6311
32	Feb. 8	116	Williams' river------	34 35 36.90	113 27 47.55	1656.8	60 35 58	14 02 09	1.6220
33	Feb. 9	117	------do ----------	34 32 29.60	113 27 34.50	1499.4	60 43 38	13 57 58	1.6275

* This camp was upon the south side of the stream of lava which threads the valley of Rio San José.
† This station was under the northern bluffs of El Moro.
‡ Much lava in the vicinity of this station.

APPENDIX G—Continued.

No. for reference.	Date.	No. of camp.	Name of place.	Latitude north.	Longitude west of Greenwich.	Elevation above the sea.	Magnetic inclination.	Magnetic declination.	Total magnetic intensity by Col. Sabine's unit of measure.
	1854.			° ′ ″	° ′ ″		° ′ ″	E. of N. ° ′ ″	
34	Feb. 13	121	Williams' river	34 16 51.10	113 26 12.45	1014.7	60 14 28	13 24 19	1.6311
35	Feb. 15	122	------do	34 12 32.40	113 33 02.85	899.3	60 07 48	13 40 41	1.6288
36	Feb. 16	123	------do	34 13 44.10	113 39 11.55	868.5	60 09 48	----------	1.6241
37	Feb. 20	126	------do	34 17 19.05	113 55 37.05	441.1	60 11 18	----------	1.6232
38	Feb. 21	128	On Colorado river	34 23 10.10	114 06 24.90	382.4	60 34 28	14 07 49	1.6260
39	Feb. 22	129	------do	34 27 26.44	114 11 18.60	416.0	60 34 38	----------	1.6284
40	Feb. 23	130	------do	34 36 19.20	114 16 05.40	589.8	60 29 38	13 51 21	1.6271
41	Feb. 25	132	------do	34 45 53.60	114 22 48.45	431.8	60 47 48	13 35 41	1.6292
42	March 1	135	------do	34 52 15.60	114 31 43.20	430.3	60 57 08	13 55 53	1.6352
43	March 3	137	Pai-ute creek	35 06 26.10	114 53 45.90	2790.7	61 09 58	14 16 32	1.6346
44	March 6	140	Near Marl springs	35 11 08.00	115 32 34.50	3792.7	60 55 48	13 59 05	1.6272
45	March 7	141	Sand camp	35 05 36.25	115 45 46.95	2038.5	60 49 08	---- -----	1.6325
46	March 8	142	Soda lake	35 03 13.20	115 58 45.90	1001.7	61 06 48	13 50 59	1.6327

APPENDIX H.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS.

[The thermometric and climatological observations made at Fort Smith, and at the various intermediate camps between that place and Beaverstown, (Camp 21,) will be found accompanying the barometric tables in Appendix I.]

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1853.			°	°	°	°	°								
Aug. 17	Camp 21	6 p. m.	85.4	76.2	29.70	24.60	5.10	29.008	736.8	19.87	65		3	Cir. & stra., 4	
17	do	9 p. m.	69.4	66.5	20.80	19.20	1.60	28.984	736.2	15.59	85		0	None	
18	do	Sunrise.	59.5	57.8	15.30	14.30	1.00	28.964	735.7	11.54	89	W.	0.5	Cirrus, 1.	Gusts of wind from the south and west were frequent during the day, principally between the hours of 11 and 2.
18	do	9 a. m.	93.6	75.3	34.20	24.10	10.10	29.100	739.1	16.08	40	N.W.	1	None	
18	do	12 m.	103.0	78.2	39.40	25.70	13.70	29.070	738.4	16.04	31	W.	1	None	
18	do	3 p. m.	114.1	84.1	45.60	28.90	16.70	29.062	738.2	20.55	29	W.	1	None	
18	do	6 p. m.	96.0	78.0	35.60	25.60	10.00	29.058	738.1	18.20	42		0	None	
18	do	9 p. m.	72.8	69.0	22.70	20.60	2.10	28.974	735.9	16.76	83		0	None	
19	do	Sunrise.	65.0	64.2	18.30	17.90	0.40	28.988	736.3	14.99	96		0	Stratus, 1.	
19	do	9 a. m.	91.3	76.7	32.90	24.80	8.10	29.074	738.5	18.30	50	N.W.	3	None	Several gusts of wind between 9 and 12 a. m.
19	do	12 m.	98.0	74.9	36.70	23.80	12.90	29.064	738.2	13.97	30	N.W.	4	Cumulus, 0.2	
19	do	3 p. m.	99.0	76.3	37.20	24.60	12.60	29.038	737.5	15.24	32	N.W.	3	Cumulus, 0.2	
19	do	6 p. m.	90.3	77.0	32.40	25.00	7.40	28.982	736.2	18.97	52		0	Cirrus, 1.	
19	do	9 p. m.	74.0	68.9	23.30	20.50	2.80	28.962	735.6	16.22	76		0	None	
20	do	Sunrise.	73.9	70.5	23.30	21.90	1.40	28.980	736.1	18.71	88	W.	1	None	Wind in gusts during the morning, and steadily increasing until noon, and decreasing towards evening.
20	do	9 a. m.	93.1	76.0	33.90	24.40	9.50	29.012	736.9	16.87	43	W.	4	None	
20	do	12 m.	100.4	77.5	38.00	25.30	12.70	28.998	736.5	16.10	33	W.	5	Cirrus, 1.	
20	do	3 p. m.	100.8	77.1	38.20	25.10	13.10	28.955	735.5	15.58	31	W.	3	Cir. & stra., 2	
20	do	6 p. m.	83.9	73.0	28.80	22.80	6.00	28.910	734.3	16.92	58		0	Cir. & stra., 3	
20	do	9 p. m.	79.0	73.4	26.10	23.00	3.10	29.007	736.8	18.98	76		0	None	Slight halo round the moon at 9 p. m.; hazy.
21	do	Sunrise.	72.8	67.8	22.70	19.90	2.80	28.940	735.1	15.53	76	S.	2	Stratus, 1.	Wind to-day same as yesterday, i. e., increasing and decreasing similarly.
21	do	9 a. m.	92.2	76.7	33.40	24.80	8.60	29.015	737.0	17.99	47	S. W.	4	Cirrus, .5	
21	do	12 m.	101.4	80.1	38.60	26.70	11.90	29.000	736.6	18.65	37	S. W.	3	Cumulus, 2.	
21	do	3 p. m.	101.6	80.6	38.10	27.00	11.10	28.966	735.7	19.61	40	S. W.	4	Cumulus, 3.	

Aug. 21	----do----------	6 p. m---	89.9	76.9	32.20	24.90	7.30	28.932	734.9	18.93	53	S. W. --	1	Cir., cum., and stra., 1.	Between 7½ and 8 p. m. saw a brilliant comet W. 12° N., and elevation 15°. Between 7½ and 8 p. m. two meteors—one N.E., the other S.E. Nucleus of comet about the magnitude of Arcturus; perhaps not quite so bright; its tail towards the zenith about 1½° in length. Its distance from Jupiter, Arcturus, and Polaris, observed.
21	----do----------	9 p. m---	79.2	73.5	26.20	23.10	3 10	28.936	735.0	19.11	76	--------	0	None ----------	
22	----do----------	Sunrise---	73.8	69.5	23.20	20.80	2.40	28.976	736.0	16.80	80	--------	0	Cirrus, 2--------	The comet was observed this evening moving to the eastward, the nucleus and train less distinctly visible, possibly due to the smoky state of the atmosphere. Meteor seen in N.W. about 8½ p. m. very bright.
22	Station 10, railroad survey.	9 a. m---	93.0	80.9	33.90	27.20	6.70	28.944	735.2	22.66	58	--------	0	-----do---------	
22	Station 23, railroad survey.	12 m.----	99.3	81.7	37.40	27.60	9.80	28.957	735.5	21.37	45	W------	4	Cumulus, 3------	
22	Camp 22---------	3 p. m---	98.6	78.0	37.00	25.60	11.40	28.862	733.1	17.33	37	S-------	7	-----do---------	
22	----do----------	6¼ p. m--	88.0	77.8	31.10	25.40	5.70	28.854	732.9	20.58	60	S-------	5	Cirrus, 2--------	
22	----do----------	9 p. m---	80.5	73.5	26.90	23.10	3.80	28.852	732.8	18.67	71	S-------	4	None ----------	
23	----do----------	Sunrise---	71.4	67.0	21.90	19.40	2.50	28.883	733.6	15.21	78	--------	0	Cir. & cum., 4---	
23	Camp 23---------	12 m.----	96.3	78.3	35.70	25.70	10.00	28.946	735.2	18.34	42	N.W----	3	Cum. & stra., 6--	
23	----do----------	3 p. m---	97.4	79.2	36.30	26.20	10.10	28.918	734.5	19.02	42	N.W----	5	Cirrus, 4--------	
23	----do----------	6 p. m---	85.6	75.6	29.80	24.20	5.60	28.854	732.9	19.00	61	N.E.----	1	Cir.-cum.-stra., 4	
23	----do----------	9 p. m---	76.4	72.7	24.70	22.60	2.10	28.896	733.9	19.09	83	N. of W.	1	Nimbus, 4-------	Thundering; appearances of rain.
24	----do----------	Sunrise---	75.0	73.0	23.90	22.80	1.10	28.946	735.2	19.94	91	W------	2	Nimbus, 1-------	
24	Station 7, railroad survey.	9 a. m---	75.6	71.9	24.20	22.20	2.00	29.038	737.5	18.67	83	N.W----	1	Nimbus, 9-------	At 9 a. m. slight shower of rain.
24	Foot of hill beyond station 19.	3 p. m---	84.8	75.2	29.30	24.00	5.30	29.024	737.2	18.91	63	N.W----	0.5	Cum. & nim., 7--	
24	Camp 24---------	6 p. m---	78.4	72.6	25.80	22.60	3.20	29.040	737.6	18.41	75	N.W----	1	Cum. & nim., 8--	
24	----do----------	9 p. m---	74.2	69.3	23.44	20.70	2.74	29.030	737.3	16.48	78	--------	0	Nimbus, 6-------	
25	----do----------	Sunrise---	68.8	66.8	20.40	19.30	1.10	29.054	738.0	15.97	91	N.W----	1	Nimbus, 10------	Cloudy during the night, with appearances of rain. Had none.
25	150 yds. in advance of station 2, railroad survey.	9 a. m---	74.2	68.2	23.40	20.10	3.30	28.984	736.2	15.48	73	N.------	0.5	Cum.-stra., 6----	
25	1,600 ft. in advance of stat'n 13, railroad survey.	12 m.----	85.9	75.3	29.90	24.10	5.80	28.974	735.9	18.74	60	-------	0	Cir.-cum., 8-----	
25	Sta'n 30, Rd. survey	3 p. m---	87.9	74.5	31.10	23.60	7.50	28.761	730.5	17.04	52	W------	0.5	Cir.-cum., 7-----	
25	Camp 25---------	6 p. m---	79.0	73.2	26.10	22.90	3.20	28.756	730.4	18.77	75	N.------	0.5	Cumulus, 4------	Comet seen this evening as usual.
25	----do----------	9 p. m---	73.5	69.5	23.10	20.80	2.30	28.740	730.0	16.86	81	S. W----	1	Nimbus, 2-------	One meteor seen in the N.E. about 8 p. m.
26	----do----------	Sunrise---	69.9	68.8	21.10	20.40	0.70	28.727	729.6	17.40	94	W------	1	Cum.-stra., 3----	Very cold during the night.
26	Half way between stations 7 and 8.	9 a. m---	86.8	75.8	30.40	24.30	6.10	28.688	728.7	18.84	59	W------	2	Cumulus, 3------	
26	Station 22---------	12 m ----	93.0	76.8	33.90	24.90	9.00	28.688	728.7	17.88	45	E.------	3	Cir.-cum.-stra., 8	
26	Station 35---------	3 p. m---	94.8	76.8	34.90	24.90	10.00	28.300	718.8	17.26	42	E. of S-	2	Cir.-cum. & nim.7	Raining at 9 p. m. Thunder and lightning during the showers. Total amount of rain during the night, .1 of an inch.
26	Camp 26---------	6 p. m- -	80.9	72.6	27.20	22.60	4.60	28.716	729.4	17.55	66	N.------	0 5	Cum.-nim.. 8----	
26	----do----------	9 p. m -	75.6	73.4	24.20	23.00	1.20	28.766	730.6	20.15	90	E.------	3	Cum.-nim., 3----	

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1853.			°	°	°	°	°								
Aug. 27	Camp 26	Sunrise	58.2	57.0	14.55	13.89	0.66	28.898	734.0	11.38	93	N	6	Nimbus, 1	
27	Station 4	9 a. m	56.8	55.0	13.78	12.78	1.00	28.876	733.4	10.39	89	N	6	Nimbus, 1	
27	Station 18	12 m	70.0	63.4	21.11	17.44	3.67	28.855	732.9	12.57	68	N	6	Cir.-cum. stra., 6	
27	Station 22	3 p. m	78.2	67.4	25.66	19.66	6.00	28.802	731.6	13.39	54	N. N. E	5	Cir.-cum. stra., 5	
27	Camp 27	6 p. m	68.3	63.7	20.16	17.61	2.55	28.884	733.6	13.41	77		0	Cir.-cum stra., 6	
27	----do	9 p. m	64.5	63.0	18.05	17.22	0.83	28.886	733.7	14.10	92		0	Cumulus, 7	
28	----do	Sunrise	60.7	58.6	15.94	14.78	1.16	28.846	732.7	11.83	89		0	Nimbus, 8	
28	Station 9	9 a. m	74.0	65.0	23.33	18.33	5.00	28.806	731.7	12.63	59		0	Cir.-cum. stra., 9	
28	Station 15	12 m	81.5	72.3	27.50	22.39	5.11	28.633	727.3	16.98	63	S. S. E.	0.5	Cir.-cum., 3	Atmosphere smoky.
28	Camp 28	4 p. m	82.1	72.6	27.83	22.55	5.28	28.520	724.4	17.07	61	S. E	2	Cir.-cum., 3	
28	----do	6 p. m	77.0	71.0	25.00	21.67	3.33	28.572	725.7	17.25	74		0	Cir.-cum., 2	
28	----do	9 p. m	72.6	69.8	22.55	21.00	1.55	28.576	725.8	17.54	88	S. E	2	None	Comet visible this evening—very brilliant. Very heavy dew during the night.
29	----do	Sunrise	68.3	67.9	20.16	19.94	0.22	28.572	725.7	17.15	98				
29	Half mile in advance of station 7.	9 a. m	81.5	74.2	27.50	23.44	4.06	28.510	724.1	18.95	69	N	2	Cirrus, 7	
29	Station 10, railroad survey.	12 m	87.5	77.4	30.83	25.22	5.61	28.458	722.8	20.35	62	S. E	5	Cum. & nim., 8	
29	Bet. sta. 18 and 19	3 p. m	86.5	75.9	30.27	24.39	5.88	28.430	722.1	18.09	60	S. E	2	Cumulus, 6	Atmosphere smoky.
29	Camp 29	6 p. m	82.3	72.3	27.94	22.39	5.55	28.557	725.3	16.71	60	S. S. E.	2	Cir. & nim., 7	
29	----do	9 p. m	75.0	73.2	23.89	22.89	1.00	28.474	723.2	20.10	91	S. W	1	Nimbus, 3	Comet visible—very brilliant.
30	----do	Sunrise	70.7	68.8	21.50	20.44	1.06	28.464	723.0	17.22	91	S. W	1	Cir.-strat., 4	
30	Station 2	9 a. m	87.0	74.0	30.55	23.33	7.22	28.480	723.4	16.87	52	S. W	2	Cir.-cum., 4	Atmosphere rather smoky.
30	Half way between stations 7 and 8.	12 m	91.1	74.9	32.83	23.83	9.00	28.426	722.0	16.42	44	S. W	6	Cir.-cum., 7	Atmosphere clear.
30	Station 15	3 p. m	93.7	75.0	34.28	23.89	10.39	28.410	721.6	15.64	40	S. W	1	Cir.-cum., 6	
30	Camp 30	6 p. m	82.3	72.5	27.94	22.50	5.44	28.412	721.7	16.91	60	S. W	0.5	Cir.-cum., 3	Two meteors seen this evening, one proceeding from the milky way in the north—very brilliant.
30	----do	9 p. m	76.0	70.1	24.44	21.17	3.27	28.411	721.6	16.69	74	W	1	Cir. strat., 1	
31	----do	Sunrise	68.1	66.0	20.06	18.89	1.17	28.362	720.4	15.54	91		0	Cir. strat., 3	
31	Half way between stations 4 and 5.	9 a. m	88.5	74.3	31.38	23.50	7.88	28.400	721.3	16.67	49	W	1	Cirrus, 2	
31	----do	12 m	96.4	79.3	35.77	26.28	9.49	28.578	725.9	19.52	45		0	Cir.-cum., 3	
31	Near station 11	4 p. m	94.5	82.0	34.72	27.78	6.94	28.414	721.7	23.45	58		0	Cumulus, 3	
31	Camp 31	6 p. m	87.0	79.5	30.55	26.39	4.16	28.485	723.5	22.98	71		0	Cir.-cum., 3	Comet visible before dark.
31	----do	9 p. m	75.0	70.0	23.89	21.11	2.78	28.468	723.1	16.92	78		0	None	

Sept.	1	Camp 31	Sunrise	67.9	65.8	19.94	18.78	1.16	28.467	723.0	15.43	91		0	None
	1	Station 3	9 a. m	92.5	72.5	33.61	22.50	11.11	28.460	722.9	13.41	35	N. W	1	None
	1	¼ mile in advance of station 9	12 m	99.5	74.0	37.50	23.33	14.17	28.376	723.3	12.58	26	S	2	Cumulus, 4
	1	1 mile in advance of station 15	3 p. m	96.5	71.0	35.83	21.67	14.16	28.276	718.2	10.59	24		0	Cumulus, 3
	1	Camp 32	6 p. m	85.1	73.9	29.50	23.28	6.22	28.303	718.9	17.41	57		0	Cumulus, 3
	1	do	9 p. m	73.0	68.0	22.78	20.00	2.78	28.261	717.8	15.68	77		0	None
	2	do	Sunrise	68.5	66.0	20.27	18.89	1.38	28.286	718.4	15.40	89		0	Cumulus, 0.5
	2	Station 8	9 a. m	92.9	72.0	33.83	22.22	11.61	28.349	720.0	15.66	32	N.N.W.	0.5	Cirrus, 1
		½ mile in advance of station 16	12 m	96.0	75.5	35.55	24.16	11.39	28.366	720.5	15.37	35	N. W	0.5	Cumulus, 4
	2	Station 19	3 p. m	97.0	71.5	36.11	21.94	14.17	28.328	719.5	10.91	25	N	1	Cumulus, 3	Wind in gusts.
	2	Camp 33	9 p. m	74.0	66.7	23.33	19.28	4.05	28.338	719.8	14.17	66		0	None	Comet not seen.
	3	do	Sunrise	65.5	64.5	18.61	18.05	0.56	28.302	718.9	15.07	96		0	Cumulus, 2
	3	1 mile in advance of station 3	9 a. m	89.5	70.0	31.94	21.11	10.83	28.206	716.4	11.96	34	W	3	None
	3	Station 14	12 m	95.0	71.0	35.00	21.67	13.33	28.201	716.3	11.10	27	W	1	Cumulus, 6
	3	Station 23	3 p. m	95.5	70.3	35.27	21.28	13.99	27.920	709.1	10.22	24	W.S.W.	1	Cumulus, 2
	3	Camp 34	6 p. m	85.7	69.0	29.83	20.55	9.28	27.904	708.7	12.29	39	W.S.W.	0.5	Cirrus, 0.8
	3	do	9 p. m	77.0	68.0	25.00	20.00	5.00	27.912	708.9	14.32	61	S.S W	3	None	Wind in gusts.
	4	do	Sunrise	65.5	61.0	18.61	16.11	2.50	27.866	707.8	12.10	77	S.W	0.5	None	Atmosphere very clear.
	4	Station 5	9 a. m	90.5	72.5	32.50	22.50	10.00	28.004	711.3	14.10	38		4	None
	4	½ mile front of station 11	12 m	95.5	69.0	35.27	20.55	14.72	27.960	710.2	8.97	22	S	2	None
	4	Camp 35	3 p. m	94.0	68.3	34.44	20.16	14.28	27.774	705.4	8.79	22	S	4	None
	4	do	6 p. m	79.0	67.0	26.11	19.44	6.67	27.770	705.3	12.74	51		0	Cir.-strat., 0.5
	4	do	9 p. m	72.9	62.9	22.72	17.17	5.55	27.788	705.8	11.18	55	S	1	None
	5	do	Sunrise	59.0	58.0	15.00	14.44	0.56	27.770	705.4	11.91	95		0	Cir.-cum., 1
	5	do	9 a. m	89.3	75.7	31.83	24.27	7.56	27.872	707.9	17.89	52		0	Cir.-cum., 1
	5	do	12 m	99.5	78.0	37.50	25.55	11.95	27.896	708.5	16.92	35	S	2	Cumulus, 7
	5	do	3 p. m	94.6	70.9	34.78	21.61	13.17	27.876	708.0	11.13	27	S	2	Cumulus, 3
	5	do	6 p. m	83.4	67.9	28.55	19.94	8.61	27.848	707.3	12.09	42	S.S.W	0.5	Cir.-cum. stra., 3
	5	do	9 p. m	73.5	65.9	23.05	18.83	4.22	27.908	708.8	13.61	65	N.E	0.5	Cir.-cum. stra., 7
	6	Camp 35	Sunrise	65.0	60.3	18.33	15.72	2.61	28.012	711.5	11.68	75	N.E.	6	Cir.-strat., 9	Very cold during last night.
	6	¼ mile advance of station 1.	9 a. m	69.0	63.0	20.55	17.22	3.33	28.109	714.0	12.58	71	N.E.	3	Cum & nim., 7
	6	1 mile front of station 5.	12 m	74.6	63.5	23.66	17.50	6.16	27.804	706.2	11.11	52	N.E.	6	Cir.-cum.-stra., 7
	6	Station 21	3 p. m	80.0	62.0	26.67	16.67	10.00	27.884	708.2	8.04	30	N		Cir.-strat., 6
	6	Camp 36	9 p. m	64.5	58.0	18.05	14.44	3 61	27.898	708.6	10.06	65		0	None
	7	do	Sunrise	54.3	53.0	12.39	11.67	0.72	27.896	708.5	9.83	93		0	Cir.-strat., 2	Heavy dew last night.
	7	Between stations 3 and 4.	9 a. m	70.5	60.5	21.39	15.83	5.56	27.998	711.1	9.97	54	N.N.W.	2	Cumulus, 3
	7	Station 11	12 m	79.2	61.5	26.22	16.39	9.83	27.846	707.3	7.89	31	E.	2	Cirrus, 3
	7	do 28	3 p. m	81.8	61.6	27.67	16.44	11.23	27.776	705.5	7.07	26	N	1	Cir.-cum., 4
	7	Camp 37	6 p. m	72.8	58.5	22.67	14.72	7.95	27.816	706.5	7.65	38	E.	0.5	Cir.-cum., 5

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches	In millimet's			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.									
1853.			°	°	°	°	°								
Sept. 7	Camp 37	9 p. m	61.0	54.0	16.11	12.22	3.89	27.780	705.6	8.25	61		0	Cir-strat., 1	
8	do	Sunrise	57.0	55.2	13.89	12.89	1.00	27.796	706.0	10.47	89		0	Cum-stra., 7	Quite cold during the night.
8	Station 4	9 a. m	73.1	64.0	22.83	17.78	5.05	27.752	704.9	12.04	59	W	0.5	Cum-stra., 6	
8	Station 16	12 m	82.6	55.6	28.11	13.11	15.00	27.791	705.9	2.10	8		0	Cir-cum., 4	
8	Station 30	3 p. m	81.5	66.0	27.50	18.89	8.61	27.746	704.7	10.97	40	W	0.5	Cumulus, 7	
8	Camp 38	6 p. m	75.6	63.0	24.22	17.22	7.00	27.662	702.6	10.33	46	E	0.5	Cir-cum-stra., 5	
8	do	9 p. m	65.7	62.7	18.72	17.05	1.67	27.672	702.9	13 44	84	E.	0.5	Cumulus, 2	
9	do	Sunrise	57.0	55.3	13.89	12.94	0.95	27.746	704.7	10.53	91		0	None	
9	Station 4	9 a. m	75.5	66.3	24.16	19.05	5.11	27.822	606.7	13.26	60	N	0.5	Cumulus, 2	
9	½ mile in advance of station 16.	12 m	79.3	66.3	26.28	19.05	7.23	27.770	705.3	11.96	47	N	0.5	Cumulus, 3	
9	Camp 39	6 p. m	75.7	62.5	24.27	16.94	7.33	27.671	702.8	10.00	45		0	Cir-strat., 1	
9	do	9 p. m	68.0	59.5	20.00	15.28	4.72	27.690	703.3	10.05	58		0	None	
10	do	Sunrise	58.2	57.3	14.55	14.06	0.49	27.666	702.7	11.66	95		0	Cirrus, 1	
10	Between stations 3 and 4.	10 a. m	76.0	65.0	24.44	18.33	6.11	27.766	705.5	11.95	53	E.	1	None	
10	Station 13	12 m	87.2	69.7	30.66	20.94	9.72	27.690	703.3	12.46	39	E.	0.5	Cirrus, 0.5	
10	Station 27	3 p. m	89.0	65.5	31.67	18.61	13.06	27.577	700.4	7.97	23	S	5	Cirrus, 0.5	
10	Camp 40	6 p. m	80.6	65.9	27.00	18.83	8.17	27.540	699.5	11.19	43	S	1	Cir-cum., 3	
10	do	9 p. m	75.0	60.5	23.89	15.83	8.06	27.552	699.8	8.46	39	S.S.E	7	Cirrus, 1	
11	Camp 40	Sunrise	58.1	56.0	14.50	13.33	1.17	27.506	698.6	10.69	89		0	Cirrus, 0.5	
11	Station 3	9 a. m	81.5	65.0	27.50	18.33	9.17	27.540	699.5	10.08	37	S. W	3	Cirrus, 0.5	
11	Station 12	12 m	91.2	65.5	32.89	18.61	14.28	27.469	697.7	7.23	19	S. S. W	6	Cirrus, 1	
11	Station 28	3 p. m	92.9	63.5	33.83	17.50	16.33	27.396	695.8	6.51	16	S. E	5	Cir.-cum., 1	
11	Camp 41	6.40 p. m	82.5	60.7	28.05	15.94	12.11	27.340	694.4	6.07	22	S. E	2	Cumulus, 2	
11	do	9 p. m	76.7	63.1	24.83	17.28	7.55	27.362	695.0	10.06	44	S	7	None	Heavy wind during night; died away before daybreak.
12	do	Sunrise	61.2	54.9	16.22	12.72	3.50	27.348	694.6	8.84	65	S. W	1	Cirrus, 1	
12	Station 2	9 a. m	77.0	62.3	25.00	16.83	8.17	27.412	696.2	9.32	40	S. W	1	None	
12	Station 10	12 m	90.9	66.0	32.72	18.89	13.83	27.346	694.6	7.78	21	S. W	1	None	
12	Half mile in advance of station 19.	3 p. m	88.7	62.3	31.50	16.83	14.67	26.968	685.0	6.97	19	E. S. E	5	Cumulus, 1	Smoky in the west during the afternoon.
12	Camp 42	6 p. m	84.0	65.0	28.89	18.33	10.56	27.012	686.1	9.22	31	S	1	None	
12	do	9 p. m	73.0	60.0	22.78	15.55	7.23	26.960	684.8	8.73	42	S	4	None	

13	----do----------	Sunrise --	64.0	61.0	17.78	16.11	1.67	26.894	683.1	12.62	84	S------	3	Cumulus, 2-----	
13	----do----------	9 a. m ---	81.0	65.0	27.22	18.33	8.89	26.939	684.2	10.25	38	S. S. W-	5	Cumulus, 2-----	
13	----do----------	12 m.----	89.3	69.5	31.83	20.83	11.00	26.910	683.5	11.55	33	W-----	3	Cir.-cum.-stra.,6.	
13	----do----------	3 p. m ---	88.7	70.0	31.50	21.11	10.39	26.844	681.8	12.22	35	W.N.W.	1	Cum.-nim., 7---	
13	----do----------	6 p. m ---	84.6	69.8	29.22	21.00	8.22	26.843	681.8	13.44	45	--------	0	Cum.-nim., 3---	
13	----do----------	9 p. m ---	71.8	63.0	22.11	17.22	4.89	26.850	682.0	11.63	59	--------	0	Cir.-strat., 1 ----	
14	----do----------	Sunrise --	54.9	53.0	12.72	11.67	1.05	26.838	681.7	9.63	87	--------	0	Cir.-cum., 1 ----	
14	----do----------	9 a. m ---	79.9	62.3	26.61	16.83	9.78	26.605	675.7	8.32	33	--------	0	Cumulus, 1-----	
14	Half-way between stations 10 & 11.	12 m.----	91.7	67.3	33.17	19.61	13.56	26.562	674.7	8.64	23	S------	1	Cir.-strat., 1----	
14	Station 18 --------	3 p. m ---	93.7	74.5	34.28	23.61	10.67	26.748	679.4	15.10	37	S------	1	Cirrus, 1 -------	
14	Camp 43 ---------	6 p. m ---	84.3	61.7	29.05	16.50	12.55	26.727	678.8	6.33	21	S. W---	0.5	Cumulus, 0.5---	
14	----do----------	9 p. m ---	80.0	59.8	26.67	15.44	11.23	26.722	678.7	6.21	24	S. W. --	4	Cumulus, 4-----	A very brilliant meteor seen at 8.40 p. m.
15	----do----------	Sunrise --	56.9	54.5	13.83	12.50	1.33	26.784	680.3	10.00	86	--------	0	None ----------	
15	Station 13 --------	12 m.----	92.5	70.0	33.61	21.11	12.50	26.596	675.5	10.94	28	W-----	2	None ----------	
15	Station 22 --------	3 p. m ---	96.7	66.0	35.94	18.89	17.05	26.516	673.5	7.67	17	W-----	6	None ----------	Very strong wind between 4 and 5 p. m. blowing from the S.S.W.
15	Camp 44 ---------	6 p. m ---	86.1	62.0	30.06	16.67	13.39	26.585	675.2	5.95	18	S. W---	2	None ----------	
15	----do----------	9 p. m ---	74.0	57.5	23.33	14.16	9.17	26.578	675.1	6.47	31	S------	2	None ----------	
16	Camp 44 ---------	Sunrise --	67.9	58.0	19.94	14.44	5.50	26.558	674.6	8.91	52	S------	7	None ----------	Wind commenced at about 12 m. last night.
16	Half-way between stations 7 and 8.	9 a. m---	87.7	60.0	30.94	15.55	15.39	26.448	671.8	5.59	16	S.W ---	6	Cumulus, 1-----	
16	Half-way between stations 14 & 15.	12m-----	89.0	60.0	31.67	15.55	16.12	26.330	668.8	5.23	14	S.W ---	6	None ----------	
16	Station 20--------	3 p. m---	92.5	59 5	33.61	15.28	18.43	26.178	664.9	3.82	9	S.W --.	4	None ----------	
16	Camp 45 ---------	6 p. m---	80.2	58.2	26.78	14.55	12.23	26.151	964.2	4.91	19	S -----	2	None ----------	
16	----do----------	9 p. m---	74.5	54.0	23.61	12.22	11.39	26.176	664.8	3.69	17	S. S.W -	3	None ----------	
17	----do----------	Sunrise --	61.5	49.9	16.39	9.94	6.45	26.230	666.2	5.24	38	W-----	0.5	None ----------	Remarkably bright before sunrise.
17	Station 12--------	9 a. m---	76.4	58.3	24.66	14.61	10.05	26.202	665.5	6.29	27	W-----	1.5	None ----------	
17	Station 15--------	12m-----	83.9	61.0	28.83	16.11	12.72	26.010	660.6	5.88	20	W-----	3	Cumulus, 1-----	
17	----------	3 p. m---	89.0	60.7	31.67	15.94	15.73	25.896	657.7	5.91	16	N.N.W.	6	Cumulus, 1-----	Very extensive mirage on prairie to-day; sometimes looking like water, at others appearing as though the prairie were on fire.
17	Station 25--------	6 p. m---	81.2	62.9	27.33	17.17	10.16	25.812	655.6	8.36	31	W-----	6	Cumulus, 1-----	
17	Camp 46 ---------	9½ p. m--	75.5	62.7	24.16	17.05	7.11	25.944	659.0	10.11	46	W.S.W.	7	Cumulus, 1-----	
18	----do----------	Sunrise --	56.8	49.5	13.78	9.72	4.06	25.958	659.3	6.56	56	N.N.E -	1	Cir.-cum., 1 ----	
18	----do----------	9 a. m ---	69.5	54.6	20.83	12.55	8.28	26.140	663.9	5.82	32	N.N.E -	6	None ----------	
18	----do----------	12m-----	76.4	57.0	24.66	13.89	10.77	26.168	664.6	5.25	24	N.N.E -	3	None ----------	
18	----do----------	3 p. m---	80.6	57.6	27.00	14.22	12.78	26.151	664.2	4.31	16	N.N E -	0.5	None ----------	
18	----do----------	6 p. m---	69.5	53.1	20.83	11.72	9.11	26.119	663.4	4.78	26	E.S.E. -	0.5	Cumulus, 0.5---	Very bright meteor seen this evening at about 7 p. m.
18	----do----------	9 p. m---	60.7	48.0	15.94	8.89	7.05	26.150	664.2	4.30	32	E -----	1	None ----------	
19	----do----------	Sunrise --	55.6	46.2	13.11	7.89	5.22	26.241	666.5	4.80	43	--------	0	Cir.-cum., 3 ----	Atmosphere very smoky during the day.
19	Sta. 5, Rd. survey -	9 a. m ---	68.7	53.5	20.39	11.94	8.45	26.298	667.9	5.34	30	S.E----	5	Cirrus, 4 -------	
19	Sta. 21, Rd. survey-	3 p. m---	82.1	64.8	27.83	18.22	9.61	26.308	668.2	9.69	35	S.E----	2	Cumulus, 4-----	
19	Camp 47 ---------	6 p. m---	73.5	58.6	23.05	14.78	8.27	26.268	667.2	7.50	36	S.S.E --	0.5	Cumulus, 3-----	
19	----do----------	9 p. m---	68.0	53.9	20.00	12.16	7.84	26.280	667.5	5.82	33	S.S.E --	3	None ----------	No clouds, but very smoky.
20	----do----------	Sunrise --	57.5	55.0	14.16	12.78	1.38	26.380	670.0	10.16	86	S.S.E --	3	Cum. & nim., 8 -	Heavy rain and wind, with thunder and lightning, during the night; cotton in barometer wet.
20	----do----------	7½ a. m --	59.0	55.5	15.00	13.05	1.95	26.440	671.5	10.02	80	W.N.W	2	----------	
20	----do----------	9 a. m ---	65.5	59.5	18.61	15.28	3.33	26.428	671.2	10.89	69	--------	0	Cum. & strat., 5-	

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches.	In millimet's			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.									
1853.			°	°	°	°	°								
Sept. 20	Sta. 5, Rd. survey	12 m	70.5	60.9	21.39	16.06	5.39	26.378	670.0	10.28	54	N	0.5	Cumulus, 8	
20	Sta. 9, Rd. survey	3 p. m	69.5	59.0	20.83	15.00	5.83	26.250	666.7	9.13	50	N.N.W.	3	Cumulus, 6	
20	Sta. 16, Rd. survey	6 p. m	62.3	55.1	16.83	12.83	4.00	26.206	665.6	8.61	61		0	Cir.-strat.-cum., 3	
20	Camp 48	9 p. m	62.0	54.5	16.67	12.50	4.17	26.180	665.0	8.28	60		0	Cum.-nimb., 8	
21	do	Sunrise	51.4	46.8	10.78	8.22	2.56	26.198	665.4	6.58	70	S	0.5	Cir.-cum., 6	
21	Sta. 2, Rd. survey	9 a. m	65.9	53.0	18.83	11.67	7.16	26.319	668.5	5.93	37	S. S. E.	2	None	Atmosphere very smoky.
21	Sta. 10, Rd. survey	12 m	74.0	61.0	23.33	16.11	7.22	26.169	664.7	9.23	43	S. W.	2	None	Very murky.
21	Sta. 18, Rd. survey	4 p. m	75.5	60.9	24.16	16.06	8.10	26.157	664.4	8.65	39	S. W.	1	Cir.-cum., 0.5	Do.
21	Camp 49	6 p. m	65.7	57.8	18.72	14.33	4.39	26.119	663.4	9.48	59		0	Cir.-cum., 0.5	The smoky atmosphere of to-day was at times so thick as to resemble clouds.
21	do	9 p. m	56.5	53.0	13.61	11.67	1.94	26.086	662.6	9.09	79		0	None	
22	do	Sunrise	54.3	51.9	12.39	11.05	1.34	26.080	662.4	9.02	86		0	None	Heavy dew last night.
22	1,175 feet front of station 3.	9 a. m	73.0	58.0	22.78	14.44	8.34	25.985	660.0	7.19	35	S. S. W.	0.5	None	No clouds, but very murky.
22	Station 7	12 m.	81.8	63.6	27.67	17.55	10.12	25.899	657.8	8.73	32		0	Cirrus, 1	Hazy.
22	Station 16	3 p. m	83.1	63.0	28.39	17.22	11.17	25.825	655.9	7.79	27	S. S. W.	0.5	Cirrus, 0.1	Do.
22	Camp 50	6 p. m	74.3	56.0	23.50	13.33	10.17	5.780	654.8	5.22	25	S	1.5	None	Do.
22	do	9 p. m	70.8	54.5	21.55	12.50	9.05	25.796	655.2	5.32	28	S. S. W.	3	None	Evening clear, moon bright.
22	Foot of Pyramid mt.	10½ a. m.	77.8					25.952							Deduced height of Pyramid mt. 556 feet.
22	Top of Pyramid mt.	11½ a. m.	79.5					25.397							
22	Top of Pyramid mt.	12 m.	81.0					25.392							
22	Foot of Pyramid mt.	1 p. m	88.2					25.912							
23	Camp 50	Sunrise	52.0	47.7	11.11	8.72	2.39	25.776	654.7	7.00	71		0	None	Very strong wind from N. between 2 and 4 this morning.
23	Sta. 6, Rd. survey	9 a. m	72.5	55.1	22.50	12.83	9.67	25.614	650.6	5.18	25		0	None	
23	Sta. 16, Rd. survey	12 m.	82.2	56.9	27.89	13.83	14.06	25.616	650.6	3.20	12	S. S. E.	2	None	Slightly smoky.
23	Sta. 18, Rd. survey	3½ p. m	80.9	54.9	27.17	12.72	14.45	25.429	645.9	2.20	8	S. S. E.	0.5	Cumulus, 0.5	
23	Camp 51	6 p. m	69.3	51.6	20.72	10.89	9.83	25.435	646.0	3.76	21	S. S. E.	0.5	None	Slightly smoky.
23	do	9 p. m	57.2	47.5	14.00	8.61	5.39	25.422	645.7	5.13	43	S. S. W.	0.5	None	Brilliant meteor seen this evening in the east at about 8 p. m.
24	do	Sunrise	47.0	42.1	8.33	5.61	2.72	25.442	646.2	5.21	64		0	None	
24	Station 5	9 a. m	70.0	51.3	21.11	10.73	10.38	25.370	644.4	3.31	17		0	None	Smoky in the N. W.
24	Station 14	12 m.	76.6	53.7	24.78	12.05	12.73	25.415	645.5	2.77	12	S. S. W.	1	None	Slightly smoky near the horizon.
24	Camp 52	6 p. m	71.9	53.0	22.17	11.67	10.50	25.360	644.1	3.91	19	S. S. E.	3	None	
24	do	9 p. m	56.2	48.9	13.44	9.39	4.05	25.352	643.9	6.36	56		0	None	

	25	Camp 52	Sunrise	42.1	40.0	5.61	4.44	1.17	25.345	643.7	5.57	84		0	Cir.-cum., 4	
	25	do	9 a. m	66.8	51.6	19.33	10.89	8.44	25.391	644.9	4.60	28	S.S.W.	2	Cir.-strat., 2	Very hazy.
	25	do	12 m.	76.1	53.5	24.50	11.94	12.56	25.364	644.2	2.82	13	S.S.E	3	Cumulus, 1	
	25	do	3 p. m	79.0	55.5	26.11	13.05	13.06	25.316	643.0	3.27	13	S.S.E	4	Cumulus, 2	Very smoky.
	25	do	6 p. m	69.5	53.0	20.83	11.67	9.16	25.296	642.5	4.72	26	S.S.E	0.5	Cumulus, 1–	Very smoky.
	25	do	9 p m	58.2	49.9	14.55	9.94	4.61	25.324	643.2	6.36	52	S	0.5	Nonc	
	26	Station 2, road survey.	Sunrise	47.5	43.0	8.61	6.11	2.50	25.268	641.8	5.55	67		0	Cum.-stra., 1	
	26	Station 8, Rd. surv.	9 a. m	65.0	51.0	18.33	10.55	7.78	24.963	634.0	4.79	31		0	Cumulus, 0.05	
	26	Station 17, Rd. surv.	12 m.	73.9	57.0	23.28	13.89	9.39	25.048	636.2	6.08	29	S.E	2	Cir.-cum., 4	
	26	Camp 53	3.30 p.m.	79.0	58.8	26.11	14.89	11.22	24.957	633.9	5.80	23	S.W	5	Cir.-cum.-nim., 5	About 2½ p. m. rained heavily for ten minutes.
	26	do	6 p. m	69.0	57.5	20.55	14.16	6.39	24.978	634.4	8.13	45	S.S.W	3	Nimbus, 9	A very slight rain, too small to measure.
	26	do	9 p. m	64.5	56.0	18.05	13.33	4.72	25.014	635.3	8.53	56			Cum.-nim., 7	
	27	do	Sunrise	59.0	54.5	15.00	12.50	2.50	25.006	635.1	9.29	74		0	Cirrus, 7	
	27	Station 5	9 a. m	66.0	56.5	18.89	13.61	5.28	24.981	634.5	8.39	52		0	Cumulus 9	
	27	Camp 54	12 m.	76.3	58.5	24.61	14.72	9.89	25.070	636.8	6.47	28		0	Cumulus 9	
	27	do	3 p. m	77.6	60.5	25.33	15.83	9.50	25.036	635.9	7.57	32	S.W	1	Cum.-nim., 9	At 4½ p. m. slight shower of rain.
	27	do	6 p. m	63.3	59.0	17.39	15.00	2.39	25.032	635.8	11.23	76	S.S.E	2	Cum.-nim., 10	At 7½ p. m. slight shower of rain with thunder.
	27	do	9 p. m	61.9	59.0	16.61	15.00	1.61	25.050	636.2	11.72	83		0	Cum.-nim., 10	
	28	do	Sunrise	57.0	56.5	13.89	13.61	0.28	25.030	635.7	11.42	98		0	Nimbus, 4	Rain last night; amount 0.21 in.
	28	do	9 a. m	66.1	60.3	18.94	15.72	3.22	25.047	636.2	11.31	70	E.N.E.	0.5	Cumulus, 6	Raining until 12 m.; am't .05 in.
	28	do	12 m.	63.0	60.0	17.22	15.55	1.67	24.984	634.6	12.13	83	E.N.E.	0.05	Cum.-nim., 4	
	28	do	3 p. m	65.3	52.1	18.50	11.17	7.33	24.953	633.8	5.47	35	E.	0.5	Cum.-nim., 7	
	28	do	6 p. m	62.0	52.9	16.67	11.61	5.06	24.958	633.9	7.17	51		0	Cum.-nim., 8	
	28	do	9 p. m	58.5	50.0	14.72	10.00	4.72	24.916	632.8	6.32	52		0	Cumulus, 5	
	29	do	Sunrise	50.5	42.7	10.28	5.94	4.34	24.932	633.2	4.41	48		0	Cir.-cum., 3	
	29	Station 2, road survey.	9 a. m	64.7	50.6	18.16	10.33	7.83	24.912	632.7	4.62	29		0	Cir.-strat, 2	
	29	Station 12, Rd. sur.	12 m.	71.3	51.6	21.83	10.89	10.94	24.476	621.7	3.09	16	S.E	0.5	Cum.-nim., 7	Slight shower of rain.
	29	Station 24, Rd. sur.	3 p. m	71.9	41.7	22.17	5.39	16.78	24.020	610.1	(*)	(*)	S.E	0.05	Cumulus, 8	(*) Inapprcciablc.
	29	Camp 55	9 p. m	57.5	45.9	14.16	7.72	6.44	24.006	609.7	3.99	33	S.E	0.05	Cumulus, 3	
	30	Camp 55	Sunrise	51.5	43.3	10.83	6.28	4.55	24.044	610.7	4.41	46	S.S.W.	0.05	Nimbus, 9	Very thick haze.
	30	Station 4	9 a. m	51.8	44.5	11.00	6.94	4.06	23.978	609.0	5.04	52	S.S.W.	0.05	Cumulus, 7	Very thick haze.
	30	Station 11	12 m.	56.5	45.8	13.61	7.67	5.94	23.958	608.5	4.25	38	S.S.W.	1	Cumulus, 7	Between 2.40 and 3.30 p. m. heavy shower of rain—amount .79.
	30	Camp 56	6 p. m	49.5	40.7	9.72	4.83	4.89	23.542	598.0	3.51	39	E.	3	Cum. & nim., 9	
	30	do	8 p. m	47.3	40.0	8.50	4.44	4.06	23.552	598.2	3.84	47	E.	4	Nimbus, 10	Thick fog.
Oct.	1	do	Sunrise	42.0	36.0	5.55	2.22	3.33	23.614	599.5	3.40	51	E.	3	None	Very thick fog.
	1	do	9 a. m	47.0	39.0	8.33	3.89	4.44	23.697	601.9	3.39	42	E.	3	Cumulus, 8	Thick haze.
	1	299 feet advance of station 2.	12 m.	56.5	41.5	13.61	5.28	8.33	23.964	608.7	1.68	15	E.	1	Cir.-cum., 8	No haze.
	1	Station 4, road survey.	3 p. m	57.8	42.3	14.33	5.72	8.61	23.987	609.2	1.73	14	N.E.	3	Cumulus, 7	Rainbow in N.E.
	1	Camp 57	6 p. m	51.0	40.0	10.55	4.44	6.11	24.017	610.0	2.61	29	S.	0.5	Cir.-cum., 3	
	1	do	9 p. m	42.0	34.0	5.55	1.11	4.44	24.022	610.1	2.34	35	E.	0.05	Cumulus, 1	Brilliant meteor in W. at 8 p. m.
	2	do	Sunrise	29.5	22.7	—1.39	—5.17	3.78	24.018	610.0	1.12	30		0	None	Very clear; heavy frost last night,

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t-t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimeters.			Direction.	Force.		
1853.			°	°	°	°	°								
Oct. 2	Between stations 0 and 1.	9 a. m	57.5	41.3	14.16	5.16	9.00	23.975	609.0	1.22	10		0	None	and ice ½ inch thick found in the buckets.
2	Station 7	12 m.	64.0	41.0	17.78	5.00	12.78	23.749	603.2	(*)	(*)	S.E	1	None	Smoky. (*) Inappreciable.
2	Station 15	3 p. m	69.0	42.0	20.55	5.55	15.00	23.716	602.4	(*)	(*)	S.E	0.5	None	Very smoky.
2	Camp 58	6 p. m	59.7	40.0	15.39	4.44	10.95	23.918	607.5	(*)	(*)	S.E	0.5	None	Smoky.
2	do	9 p. m	46.3	37.5	7.94	3.05	4.89	23.888	606.7	2.79	36		0	None	
3	do	Sunrise	32.0	23.9	0.00	−4.50	4.50	23.872	606.3	0.90	20		0	None	
3	Station 3	9 a. m	58.5	42.9	14.72	6.05	8.67	24.296	617.1	1.82	15		0	None	
3	Station 11	12 m.	71.0	47.0	21.67	8.33	13.34	24.868	631.6	(*)	(*)	S.W	0.5	Cumulus, 1	Atmosphere smoky.
3	Station 17	3 p. m	78.7	52.0	25.94	11.11	14.83	25.354	644.0	0.81	4		0	Cir.-cum., 3	(*) Inappreciable.
3	Camp 59, Albuquerque.	6 p. m	71.5	48.5	21.94	9.16	12.78	25.320	643.1	0.84	6	S.W	0.5	Cumulus, 1	
3	do	9 p. m	54.8	42.2	12.67	5.66	7.01	25.288	642.3	2.67	22		0	Cumulus, 1	Clear atmosphere.
4	do	Sunrise	39.7	31.5	4.28	−0.28	4.56	25.313	642.9	1.87	32		0	None	Slight dew last night.
4	do	9 a. m	72.3	50.0	22.39	10.00	12.39	25.392	644.9	1.58	10		0	None	Atmosphere smoky.
4	do	12 m.	84.7	61.0	29.28	16.11	13.17	25.399	645.1	5.61	19		0	None	
4	do	3 p. m	87.5	56.5	30.83	13.61	17.22	25.335	643.5	3.43	10		0	None	
4	do	6 p. m	72.0	56.5	22.22	13.61	8.61	25.282	642.1	6.36	32	S.W	0.5	Cumulus, 2	
4	do	9 p. m	54.4	41.5	12.44	5.28	7.16	25.260	641.6	2.38	22		0	None	
5	do	Sunrise	41.0	38.0	5.00	3.33	1.67	25.254	641.4	4.82	74		0	None	
5	do	9 a. m	64.8	51.3	18.22	10.73	7.49	25.364	644.2	5.09	33	N. E	1	Cir.-strat, .8	
5	do	12 m.	83.4	64.0	28.55	17.77		25.364	644.2			N. W	0.5	Cir.-cum , .7	
5	do	6 p. m	67.5	55.0	19.72	12.77		25.274	641.9			S	1	Cirrus, 7	
5	do	9 p. m	64.1	49.0	17.83	9.44	8.39	25.286	642.2	3.76	25	E	1	Cumulus, 1	
6	do	Sunrise	40.0	36.3	4.44	2.39	2.05	25 262	641.6	4.23	68		0	Cirrus, 7	
6	do	9 a. m	73.1	57.0	22.83	13.89	8.94	25.334	643.5	6.36	32		0	Cirrus, 7	
6	do	3 p. m	84.0	55.2	28.89	12.89	16.00	25.238	641.0	2.99	10	S. S. E	1	Cirrus, 3	Very foggy.
6	do	6 p. m	65.6	51.0	18.66	10.55	8.11	25.201	640.1	4.59	29		0	Cumulus, 1	
6	do	9 p. m	50.0	49.0	10.00	9.44	0.56	25.184	639.7	8.49	95		0	None	
7	do	Sunrise	37.5	35.0	3.05	1.67	1.38	25.208	640.3	4.38	79		0	None	
7	do	9 a. m	72.0	56.5	22.22	13.61	8.61	25.300	642.6	6.36	32		0	None	Very foggy.
7	do	12 m	86.0	57.0	30.00	13.89	16.11	25.294	642.4	3.22	10		0	None	Atmosphere very smoky

7	----do----------	3 p. m---	100.6	68.0	38.11	20.00	18.11	25.260	641.6	7.53	16	--------	0	None ----------	Very smoky.
7	----do----------	5½ p. m--	67.0	63.0	19.44	17.22	2.22	25.182	639.6	13.26	79	--------	0	None ----------	Still smoky.
7	----do----------	9 p. m---	54.5	45.0	12.50	7.22	5.28	25.180	639.6	4.43	41	--------	0	None ----------	
8	----do----------	Sunrise --	34.5	31.5	1.39	—0.28	1.67	25.170	639.3	3.52	71	--------	0	Cirrus, 1 -------	
8	----do----------	9 a. m---	70.5	50.0	21.39	10.00	11.39	25.280	642.1	2.28	12	--------	0	None ----------	Very smoky
8	----do----------	12 m------	79.0	57.2	26.11	14.00	12.11	25.242	641.1	4.55	18	E ------	0.5	Cirrus, 1 -------	Very foggy.
8	----do----------	3 p. m---	83.5	60.0	28.61	15.55	13.06	25.196	640.0	5.18	18	--------	0	None ----------	
8	----do----------	Sunset ---	72.0	59.3	22.22	15.17	7.05	25.054	636.3	8.54	43	--------	0	None ----------	
8	----do----------	9 p. m---	51.7	45.0	10.94	7.22	3.72	25.138	638.5	5.37	56	--------	0	None ----------	Smoky.
9	----do----------	Sunrise---	35.0	32.6	1.67	0.33	1.34	25.138	638.5	3.91	78	--------	------	----------	
9	----do----------	9 a. m---	68.9	50.8	20.50	10.44	10.06	25.200	640.1	3.35	19	--------	------	----------	
9	----do----------	1 p. m---	80.5	58.7	26.94	14.83	12.11	25.157	639.0	5.20	20	--------	0	Cumulus, 1------	
9	----do----------	3 p. m---	79.5	60.5	26.39	15.83	10.56	25.079	637.0	6.93	27	--------	0	None ----------	Smoky.
9	----do----------	8 p. m---	51.7	45.0	10.94	7.22	3.72	25.075	636.9	5.37	56	S. E ---	0.05	Cumulus, 2------	
9	----do----------	9 p. m---	51.7	45.0	10.94	7.22	3.72	25.070	636.8	5.37	56	--------	------	None ----------	
10	----do----------	Sunrise --	44.0	40.0	6.67	4.44	2.23	25.098	637.5	4.93	68	--------	------	----------	
10	----do----------	12 m------	86.6	66.0	30.33	18.89	11.44	25.199	640.0	9.25	29	--------	0	Cumulus, 3------	
10	----do----------	3 p. m---	86.6	66.0	30.33	18.89	11.44	25.149	638.8	9.25	29	S.S.E --	2	Cumulus, 3------	Wind in gusts.
10	----do----------	6 p. m---	69.3	60.0	20.72	15.55	5.17	25.115	637.9	9.99	56	--------	0	Cir.-cum., 2 ----	
10	----do----------	9 p. m---	48.0	------	------	------	------	25.115	637.9	------	----	--------	0	None ----------	
11	----do----------	Sunrise --	43.0	18.5	6.11	—7.50	13.61	25.148	638.7	(*)	(*)	--------	0	None ----------	(*) Inappreciable.
11	----do----------	9 a. m ---	69.2	55.0	20.67	12.78	7.89	25.288	642.3	6.22	34	--------	0	Cirrus, 7 -------	
11	----do----------	12 m------	78.5	62.0	25.83	16.67	9.16	25.275	642.0	8.55	35	--------	0	Cir.-cum., 6 ----	
11	----do----------	3 p. m---	80.0	66.0	26.67	18.89	7.78	25.244	641.2	11.49	45	--------	0	Cir.-cum., 5 ----	
11	----do----------	6 p. m---	65.0	56.1	18.33	13.39	4.94	25.204	640.2	8.44	55	--------	0	Cir.-cum., 4 ----	
11	----do----------	10 p. m--	53.0	47.0	11.67	8.33	3.34	25.186	639.7	6.20	62	--------	0	Cir.-cum., 0.5 --	
12	----do----------	Sunrise --	43.1	40.0	6.17	4.44	1.73	25.192	639.9	5.23	76	N ------	0.05	None ----------	Clear in the west; rest smoky.
12	----do----------	9 a. m ---	65.0	52.9	18.33	11.61	6.72	25.254	641.4	6.16	40	N ------	0.05	Cir.-cum., 3 ----	
12	----do----------	12 m------	84.0	66.0	28.89	18.89	10.00	25.248	641.3	10.13	34	--------	0	Cir.-cum., 4 ----	
12	----do----------	3 p. m---	88.1	66.5	31.17	19.16	12.01	25.194	639.9	9.15	27	--------	0	Cir.-cum., 6 ----	
12	----do----------	6 p. m---	71.8	62.8	22.11	17.11	5.00	25.144	638.6	11.47	58	--------	0	Cir.-cum., 9----	
12	----do----------	9 p. m---	66.7	58.3	19.28	14.61	4.67	25.160	639.0	9.56	57	E ------	0.05	Cum.-strat., 9---	
13	----do----------	Sunrise --	54.5	52.0	12.50	11.11	1.39	25.149	638.8	9.03	83	--------	0	Cir.-cum , 8 ----	
13	----do----------	9 a. m ---	83.5	66.0	28.61	18.89	9.72	25.207	640.2	10.30	36	--------	0	Cir -cum., 2 ----	
13	----do----------	12 m------	88.9	71.5	31.61	21.94	9.67	25.204	640.2	13.68	40	--------	0	Cir.-cum., 4 ----	
13	----do----------	3 p. m---	79.1	64.2	26.17	17.89	8.28	25.090	637.3	10.25	41	--------	0	Cum.-nim., 7---	
13	----do----------	6 p. m---	69.0	59.5	20.55	15.28	5.27	25.110	637.8	9.71	54	--------	0	Cum.-nim., 8---	At 8½ p. m. wind in gusts from W.N.W. with a few drops of rain.
13	----do----------	9 p. m---	62.9	56.5	17.17	13.61	3.56	25.133	638.4	9.44	66	--------	0	Cum.-nim., 7---	
14	----do----------	Sunrise --	50.0	47.0	10.00	8.33	1.67	25.179	639.5	7.20	79	--------	------	----------	
14	----do----------	9 a. m ---	70.9	61.8	21.61	16.55	5.06	25.192	639.9	10.95	57	W.N.W	0.05	Cumulus, 3------	
14	----do----------	12 m------	66.5	56.0	19.16	13.33	5.83	25.280	642.1	7.85	47	S.E-----	5	Cumulus, 5------	
14	----do----------	4 p. m---	68.0	55.1	20.00	12.83	7.17	25.244	641.2	6.70	39	S.S.E --	6	Cir.-cum., 6----	
14	----do----------	6 p. m---	59.9	51.0	15.50	10.55	4.95	25.237	641.0	6.50	51	S.S.E --	6	Cumulus, 7------	
14	----do----------	9 p. m---	57.0	52.0	13.89	11.11	2.78	25.325	643.2	8.19	71	S.S.E --	2	Cum.-nim., 9----	Raining slightly; wind in gusts.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direc. tion.	Force.		
1853.			°	°	°	°	°								
Oct. 15	Albuquerque	Sunrise	52.8	50.0	11.55	10.00	1.55	25.290	642.3	8.23	83		0	Cum.-nim., 9	Some rain last night; too little to measure.
15	do	9 a. m	59.3	55.2	15.17	12.89	2.28	25.358	644.1	9.69	76		0	Cum.-nim., 8	
15	do	12 m	83.0	71.7	28.33	22.05	6.28	25.236	641.0	15.85	56	N.W	0.5	Cir.-cum. stra. nim. 9.	
15	do	3 p. m	68.5	58.3	20.27	14.61	5.66	25.269	641.8	8.96	50		0	Cir.-strat., 1	
15	do	6 p. m	59.5	52.3	15.28	11.28	4.00	25.238	641.0	7.56	58		0	Cir.-eum., 9	
15	do	9 p. m	62.5	55.5	16.94	13.05	3.89	25.274	641.9	8.83	63	N.W	3	Cir.-eum., 9	
16	do	Sunrise	53.7	51.0	12.05	10.55	1.50	25.282	642.1	8.59	83	N.W	3	Cir.-cum., 7	
16	do	9 a. m	57.5	53.0	14.16	11.67	2.49	25.300	642.6	8.75	73	N.W	2	Cir.-cum., 9	
16	do	12 m	61.5	55.0	16.39	12.78	3.61	25.314	643.0	8.81	63	N.W	4	Cir.-cum., 10	Wind in gusts.
16	do	3 p. m	63.0	54.5	17.22	12.50	4.72	25.291	642.4	7.95	55	N.W	2	Cir.-cum., 9	
16	do	5.40 p. m.	58.0	53.5	14.44	11.94	2.50	25.280	642.1	8.93	74	N	2	Cir.-nim., 7	Raining very slightly.
16	do	9 p. m	51.5	49.0	10.83	9.44	1.39	25.282	642.1	7.98	82		0	Cum.-nim., 4	
17	do	Sunrise	49.3	48.1	9.61	8.94	0.67	25.308	642.8	8.09	92	N	0.5	Cumulus, 5	
17	do	9 a. m	58.7	55.0	14.83	12.78	2.05	25.396	645.0	9.76	78	N	0.5	Cumulus, 8	
17	do	12 m	78.6	70.0	25.89	21.11	4.78	25.404	645.2	15.69	64	N	0.05	Cum.-nim., 7	
17	do	3 p. m	75.2	62.9	24.00	17.17	6.83	25.336	643.5	10.40	47	E.S.E	1	Cumulus, 5	
17	do	5.35 p. m.	68.0	60.5	20.00	15.83	4.17	25.307	642.8	10.82	64	N.E.	0.5	Cirrus, 2	
17	do	9 p. m	58.3	53.0	14.61	11.67	2.94	25.318	643.1	8.48	69	N.E.	2	Cirrus, 1	
18	do	9 a. m	65.6	60.0	18.66	15.55	3.11	25.362	644.2	11.24	71		0		Very smoky.
18	do	12 m	79.2	64.5	26.22	18.05	8.17	25.298	642.5	10.41	42		0	Cumulus, 2	
18	do	3 p. m	81.5	68.3	27.50	20.16	7.34	25.299	642.6	13.16	48		0	Cumulus, 3	
18	do	5.30 p. m.	69.5	61.6	20.83	16.44	4.39	25.252	641.4	11.23	61		0	Cumulus, 3	
18	do	9 p. m	54.0	48.0	12.22	8.89	3.33	25.232	640.9	6.54	62	N	0.5	Cumulus, 6	
19	do	9 a. m	75.2	66.3	24.00	19.05	4.95	25.310	642.9	13.36	61		0	Cumulus, 1	
19	do	12 m	79.9	69.5	26.61	20.83	5.78	25.314	643.0	14.75	58		0	Cumulus, 1	
19	do	3 p. m	86.5	69.6	30.27	20.89	9.38	25.277	642.0	12.61	40		0	Cumulus, 1	
19	do	5.30 p. m.	70.0	61.5	21.11	16.39	4.72	25.224	640.7	11.01	59		0	None	
19	do	9 p. m	52.9	48.0	11.61	8.89	2.72	25.198	640.0	6.91	69		0	None	
20	do	9 a. m	71.5	61.5	21.94	16.39	5.55	25.290	642.3	10.50	54	W.S.W.	1.5	Cumulus, 2	
20	do	12 m.	80.5	65.1	26.94	18.39	8.55	25.268	641.8	10.52	40	N.E	0.5	Cir.-eum., 3	Atmosphere very smoky.
20	do	3 p. m	78.0	59.1	25.55	15.06	10.49	25.180	639.6	6.37	26	W.N.W.	2	Cumulus, 6	
20	do	Sunset	66.9	54.0	19.39	12.22	7.17	25.122	638.1	6.27	38	N.W	0.5	Cir.-strat, 3	

20	----do----------	9 p. m---	60.5	51.9	15.83	11.05	4.78	25.124	638.1	6.93	53	N.W. --	1	Cir.-strat., 7----	
21	----do----------	Sunrise.--	45.5	41.5	7.50	5.28	2.22	25.130	638.3	5.35	69	N.------	0.5	Cirrus, 2-------	
21	----do----------	9 a. m ---	65.5	54.5	18.61	12.50	6.11	25.222	640.6	7.10	44	N.N.E.-	2	Cumulus, 0.5---	
21	----do----------	12 m.----	82.0	62.7	27.78	17.05	10.73	25.200	640.1	7.90	29	E.-----	0.5	Cirrus, 3-------	
21	----do----------	3 p. m---	83.5	66.5	28.61	19.16	9.45	25.096	637.4	10.72	37	N.N.E.-	1	Cirrus, 3-------	
21	----do----------	Sunset ---	65.2	50.9	18.44	10.50	7.94	25.060	636.5	4.67	30	N.N.W.-	0.5	Cirrus, 1-------	
21	----do----------	9 p. m---	47.1	45.0	8.39	7.22	1.17	25.054	636.3	6.90	86	N.N.W.	1	Cirrus, 2-------	
22	----do----------	Sunrise.--	37.3	------	------	------	------	24.978	634.4	------	----	--------	0	Cir.-strat., 6----	
22	----do----------	9 a. m.--	60.5	53.0	15.83	11.67	4.16	25.032	635.8	7.73	59	--------	0	Cir.-strat., 3----	
22	----do----------	12 m.----	71.4	61.0	21.89	16.11	5.78	24.980	634.5	10.11	53	E.S.E.--	0.5	Cir.-strat., 3----	
22	----do----------	3 p. m---	66.0	54.2	18.89	12.33	6.56	24.961	634.0	6.71	42	N.E.----	3	Cir.-cum., 7----	
22	----do----------	Sunset ---	50.0	46.0	10.00	7.78	2.22	24.994	634.8	6.55	72	N.E.----	6	None ----------	
22	----do----------	9 p. m---	38.2	36.0	3.44	2.22	1.22	25.075	636.9	4.67	80	N.E.----	6	Cir.-cum., 1.----	
23	----do----------	9 a. m---	44.0	30.0	6.67	—1.11	7.78	25.204	640.2	(*)	(*)	--------	0	Cum.-strat., 8---	(*) Inappreciable.
23	----do----------	12 m.----	61.0	45.0	16.11	7.22	8.89	25.214	640.4	2.26	16	S------	0.5	Cumulus, 2------	
23	----do----------	3 p. m---	72.0	55.0	22.22	12.78	9.44	25.216	640.5	5.28	26	W.S.W.-	0.5	None ----------	Very smoky.
23	----do----------	5 30 p. m	48.7	47.0	9.28	8.33	0.95	25.184	639.7	7.61	89	N.------	0.5	None ----------	Very smoky.
23	----do----------	9 p. m---	34.0	30.0	1.11	—1.11	2.22	25.198	640.0	3.01	64	E.N.E.-	1	None ----------	
24	----do----------	Sunrise.--	25.0	------	------	------	------	25.244	641.2	------	----	--------	0	Cirrus, 5 -------	
24	----do----------	9 a. m.--	63.3	54.0	17.39	12.22	5.17	25.311	642.9	7.48	52	--------	0	Cirrus, 5 -------	
24	----do----------	12 m.----	62.0	47.8	16.67	8.78	7.89	25.247	641.2	3.74	26	S.S.W.--	0.5	Cirrus, 3 -------	
24	----do----------	3 p. m---	70.8	56.0	21 55	13.33	8.22	25.122	638.1	6.40	33	S.S.W.--	0.5	Cirrus, 1 -------	
24	----do----------	6 p. m---	50.0	41.5	10.00	5.28	4.72	25.036	635.9	3.85	42	--------	0	Cirrus, 3 -------	
24	----do----------	9 p. m---	44.0	37.0	6.67	2.78	3.89	24.974	634.3	3.30	45	--------	0	Cirrus, 1 -------	
25	----do----------	Sunrise.--	42.0	38.0	5.55	3.33	2.22	24.978	634.4	4.49	66	--------	0	Cirrus, 6 -------	Other observations omitted on account of a remarkably strong wind, which commenced at or about 9 a. m., shaking tent-poles and other movables.
25	----do----------	9 a. m.--	57.8	51.0	14.33	10.55	3.78	24.874	631.8	7.21	60	W.S.W.	1	Cum.-strat., 8---	
25	----do----------	Sunset----	52.5	41.9	11.39	5.50	5.89	24.956	633.9	3.26	33	S.S.W.--	8	Cirrus, 6 -------	
26	----do----------	Sunrise.--	29.5	------	------	------	------	25.016	635.4	------	----	--------	------	None----------	
26	----do----------	9 a. m.--	53.5	42.7	11.94	5.94	6.00	25.121	638.1	3.41	33	N.W.---	1	None----------	Smoky.
26	----do----------	12 m ----	70.5	59.0	21.39	15.00	6.39	25.142	638.6	5.81	48	N.------	1	Cumulus, 2------	Wind in gusts.
26	----do----------	3 p. m---	68.0	55.5	20.00	13.05	6.95	25.105	637.6	6.97	41	W------	0.5	Cumulus, 1------	
26	----do----------	6 p. m---	49.0	42.0	9.44	5.55	3.89	25.052	636.3	4.48	51	--------	0	None ----------	Bright meteor seen at about 7 p. m. in N.W.; large, brilliant; movement slow towards W.
26	----do----------	9 p. m---	34.5	30.0	1.39	—1.11	2.50	25.044	636.1	2.86	61	--------	0	None ----------	
27	----do----------	9 a. m.--	63.5	54.8	17.50	12.67	4.83	25.196	640.0	7.99	54	--------	0	None ----------	
27	----do----------	12 m.----	79.1	67.5	26.17	19.72	6.45	25.216	640.5	13.18	52	--------	0	None ----------	
27	----do----------	3 p. m---	70.3	58.0	21.28	14.44	6.84	25.168	639.2	8.10	43	W.N.W.	6	None ----------	
27	----do----------	6 p. m---	51.6	50.0	10.89	10.00	0.89	25.156	638.9	8.63	90	W.N.W.	5	None ----------	
28	----do----------	Sunrise.--	33.5	------	0.83	------	------	25.233	640.9	------	----	--------	0	None ----------	
28	----do----------	9 a. m.--	74.5	55.0	23.61	12.78	10.83	25.328	643.3	4.43	20	--------	0	None ----------	
28	----do----------	12 m.----	75.4	60.0	24.11	15.55	8.56	25.442	646.2	7.93	36	--------	0	Cumulus, 1------	
28	----do----------	3 p. m---	74.0	60.0	23.33	15.55	7.78	25.446	646.3	8.40	40	--------	0	Cumulus, 0.5---	
28	----do----------	9 p. m---	58.2	50.9	14.55	10.50	4.05	25.410	645.4	7.02	57	W------	0.5	None ----------	Atmosphere clear.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t-t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches.	In millimet's			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.									
1853.			°	°	°	°	°								
Oct. 29	Albuquerque	Sunrise.	33.0	32.0	0.55	0.00	0.55	25.179	639.5	4.27	92		0	None	
29	do	9 a. m.	58.0	50.0	14.44	10.00	4.44	25.528	648.4	6.49	53		0	Cirrus, 1	
29	do	12 m.	78.3	65.5	25.72	18.61	7.11	25.584	649.8	11.61	48		0	None	
29	do	3 p. m.	81.5	66.6	27.50	19.22	8.28	25.546	648.8	11.47	42		0	None	Misty.
29	do	6 p. m.	62.0	54.0	16.67	12.22	4.45	25.488	647.4	7.91	56		0	None	
30	do	9. a. m.	59.5	50.4	15.28	10.22	5.06	25.496	647.6	6.24	48		0	None	
30	do	12 m.	84.5	69.5	29.16	20.83	8.33	25.478	647.1	13.19	45		0	None	
30	do	3 p. m.	74.5	56.0	23.61	13.33	10.28	25.481	647.2	5.13	24		0	None	
30	do	9 p. m.	35.5	31.5	1.94	—0.28	2.22	25.452	646.5	3.18	63		0	None	Very brilliant meteor at 7 p. m. passing from E. to W., angle 45°.
31	do	9 a. m.	61.2	52.5	16.22	11.39	4.83	25.126	638.2	7.14	52		0	None	169 observations give 62°.2 Fahr. for the mean temperature during the month of October. The highest temperature observed is 100°.6; the lowest 25° Fahr.
31	do	12 m.	75.4	61.5	24.11	16.39	7.72	25.174	639.4	9.18	41		0	None	
31	do	3 p. m.	79.5	62.9	26.39	17.17	9.22	25.106	637.7	8.94	35	S.E.	0.5	None	Very smoky.
31	do	6 p. m.	63.5	52.7	17.50	11.50	6.00	25.039	636.0	6.51	43	S.	0.05	None	Brilliant meteor seen this evening about 7 p. m. passing from east to west, angle 45°.
31	do	9 p. m.	42.0	31.5	5.55	—0.28	5.83	24.994	634.8	1.15	8		0	None	
Nov. 1	do	Sunrise.	42.5	38.0	5.83	3.33	2.50	25.020	635.5	4.32	63		0	None	
1	do	9 a. m.	61.7	54.0	16.50	12.22	4.28	25.053	636.3	8.01	58	S.S.W.	0.5	None	
1	do	12 m.	82.4	67.0	28.00	19.44	8.56	25.068	636.7	11.59	42		0	Cumulus, 0.5	
1	do	3 p. m.	80.3	59.3	26.83	15.17	11.66	24.994	634.8	5.73	22	S.W.	4	Cumulus, 5	
1	do	6 p. m.	66.2	49.7	19.00	9.83	9.17	24.970	634.2	3.54	22	W.	1	Cumulus, 5	Brilliant meteor seen at 7.15 p. m. passing from east to west. angle from 40° to 50°.
1	do	9 p. m.	43.0	39.0	6.11	3.89	2.22	24.978	634.4	4.71	67		0	Cumulus, 3	
2	do	Sunrise.	27.5	26.5	—2.50	—3.06	0.56	25.112	637.8	3.36	92		0	None	
2	do	9 a. m.	58.9	44.1	14.94	6.72	8.22	25.250	641.3	2.43	19	N.N.W.	1	None	Smoky atmosphere.
2	do	12 m.	75.5	58.9	24.16	14.94	9.22	25.278	642.0	7.05	32	W.N.W.	3	None	
2	do	3 p. m.	71.2	55.9	21.78	13.28	8.50	25.258	641.5	8.19	32	W.	1	None	
2	do	6 p. m.	55.2	45.8	12.89	7.67	5.22	25.236	641.0	4.69	42	N.W.	0.5	None	
2	do	9 p. m.	29.5									W.	0.5	None	
3	do	Sunrise.	28.0										0	None	
3	do	9 a. m.	49.7	41.0	9.83	5.00	4.83	25.361	644.1	3.64	40	N.W.	0.5	Cir.-cum, 1.	Atmosphere very smoky.
3	do	12 m.	81.5	66.5	27.50	19.16	8.34	25.364	644.2	11.40	42		0	Cirrus, 3	
3	do	3 p. m.	74.2	58.5	23.44	14.72	8.72	25.308	642.8	7.18	34		0	Cirrus, 1	

3	----do----------	6 p. m---	63.5	51.8	17.50	11.00	6.50	25.282	642.1	5.86	40	--------	0	Cirrus, 2------	
3	----do----------	9 p. m---	39.0	32.5	3.89	0.28	3.61	25.232	640.9	2.54	42	--------	0	None ----------	
4	----do----------	9 a. m---	64.5	54.0	18.05	12.22	5.83	25.378	644.6	7.07	46	N.------	0.5	None ----------	Very hazy.
4	----do----------	12 m ----	75.0	62.1	23.89	16.72	7.17	25.359	644.1	9.81	45	--------	0	None ----------	Do.
4	----do----------	3 p. m---	77.2	61.4	25.11	16.33	8.78	25.310	642.9	8.47	36	--------	0	Cirrus, 0.5-----	
4	----do----------	Sunset ---	54.0	46.0	12.22	7.78	4.44	25.258	641.5	5.22	49	--------	0	Cirrus, 5-------	
4	----do----------	9 p. m---	36.5	33.1	2.50	0.61	1.89	25.226	640.7	3.66	68	--------	0	None ----------	
5	----do----------	9 a. m---	58.0	49.0	14.44	9.44	5.00	25.404	645.2	5.82	47	--------	0	None ----------	Hazy.
5	----do----------	12 m.----	70.5	55.6	21.39	13.11	8.28	25.338	643.6	6.21	33	--------	0	Cirrus, 6-------	
5	----do----------	3 p. m---	80.0	63.7	26.67	17.61	9.06	25.279	642.1	9.48	36	S.S.W.--	0.05	Cirrus, 7-------	
5	----do----------	Sunset ---	57.2	49.5	14.00	9.72	4.28	25.226	640.7	6.42	54	--------	0	Cirrus, 7-------	
6	----do----------	10 a. m--	63.1	53.9	17.28	12.16	5.12	25.264	641.7	7.47	52	N.E.----	0.5	Cirrus, 5-------	Very misty.
6	----do----------	12 m.----	68.2	58.7	20.11	14.83	5.28	25.210	640.3	9.36	54	S.------	0.5	Cir.-cum., 9.----	
6	----do----------	3 p. m---	70.2	60.9	21.22	16.06	5.16	25.154	638.9	10.45	57	--------	0	Cirrus, 8-------	Do.
6	----do----------	9 p. m---	51.0	48.1	10.55	8.94	1.61	25.100	637.5	7.60	80	--------	0	Cirrus, 8-------	
7	----do----------	Sunrise.--	37.0	35.0	2.78	1.67	1.11	25.082	637.1	4.55	82	--------	0	Cir.-cum., 1 ----	
7	----do----------	9 a. m---	54.5	50.0	12.50	10.00	2.50	25.094	637.4	7.66	72	--------	0	Cum.-strat., 8---	
7	----do----------	12 m.----	58.0	50.5	14.44	10 28	4.16	25.094	637.4	6.82	57	--------	0	Cir.-cum.,8-----	
7	----do----------	Sunset ---	55.0	49.5	12.78	9.72	3.06	25.024	635.6	7.17	66	S.S.E.--	2	Cir.-cum., 8-----	
8	----do----------	Sunrise.--	38.0	35.0	3.33	1.67	1.66	25.288	642.3	4.21	72	--------	0	Cumulus, 8------	
8	----do----------	9 a. m---	51.4	44.5	10.78	6.94	3.84	25.364	644.2	5.17	54	W.N.W.	2	Cumulus, 8------	
8	----do----------	12 m.----	57.0	47.0	13.89	8.33	5.56	24.884	632.0	4.86	42	N.W.---	4	Cumulus, 4------	
8	Camp 60, on Rio Grande, opposite camp 59.	9 p. m---	45.7	39.0	7.61	3.89	3.72	25.546	648.8	3.82	50	E.------	3	None.----------	
9	----do----------	Sunrise.--	32.0	29.0	0.00	—1.67	1.67	25.520	648.2	3.18	71	N.------	1	Cirrus, 3-------	
9	Station 6, Rd. survey.	9 a. m---	49.9	40.2	9.94	4.55	5.39	25.572	649.5	3.10	35	N.W.---	1	Cirrus, 4-------	
9	Station 11, Rd. survey.	3 p. m---	60.2	47.3	15.66	8.50	7.16	25.064	636.6	4.00	31	W.S.W.	2	Cirrus, 6-------	
9	Station 15, Rd. survey.	Sunset.---	50.9	40.0	10.50	4.44	6.06	25.412	645.4	2.65	29	--------	0	Cir.-strat., 6----	
9	Camp 61, near Isleta.	9 p. m---	37.5	32.5	3.05	0.28	2.77	25.348	643.8	3.04	55	E.------	0.5	Cirrus, 1-------	
10	------do----------	Sunrise.--	25.0	------	------	------	------	------	------	------	----	--------	0	Cirrus, 1-------	
10	------do----------	9 a. m---	72.0	49.1	22.22	9.50	12.72	25.255	641.5	1.12	6	--------	0	Cirrus, 2-------	Atmosphere smoky.
10	100 yards back of station 1.	12 m.----	64.5	47.5	18.05	8.61	9.44	25.109	637.7	2.80	17	S.E.----	0.5	Cirrus, 3-------	
10	Station H, Rd. survey.	3 p. m---	65.5	49.0	18.61	9.44	9.17	24.665	626.5	3.31	20	--------	0	Cirrus, 5-------	
10	Half mile advance of station 3.	Sunset.---	58.5	43.0	14.72	6.11	8.61	24.574	624.2	1.88	16	--------	0	Cirrus, 5-------	
11	Camp 62 ---------	Sunrise.--	23.0	------	------	------	------	24.824	630.5	------	----	--------	0	None ----------	
11	----do----------	9 a. m---	50.0	42.7	10.00	5.94	4.06	24.924	633.0	4.57	50	--------	0	None ----------	
11	Station 6, Rd. survey.	1 p. m---	64.5	44.3	18.05	6.83	11.22	24.479	621.7	0.68	5	W.S.W.	5	Cirrus, 2 -------	

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued

Date.	Station.	Hour.	Reading of psyehrometer.				Difference $t-t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1853.			°	°	°	°	°								
Nov. 11	Between stations 16 and 17.	4 p. m.	67.5	45.5	19.72	7.50	12.22	24.500	622.3	(*)	(*)	W.	4	Cirrus, 2	(*) Inappreciable.
11	Between stations 18 and 19	Sunset	61.5	41.9	16.39	5.50	10.89	24.457	621.2	(*)	(*)	W.	3	Cirrus, 4	(*) Inappreciable.
11	Camp 63	9 p. m.	46.9	41.9	8.28	5.50	2.78	24.512	622.6	5.12	64		0	None	
12	do	Sunrise.	33.0					24.657	626.3				0	None	
12	do	12 m.	75.2	57.0	24.00	13.89	10.11	24.746	628.5	5.64	26	S.	0.5	None	
12	do	3 p. m.	80.2	58.2	26.78	14.55	12.23	24.708	627.6	4.91	19	S.	0.5	Cirrus, 3	
12	do	6 p. m.	58.5	45.3	14.72	7.39	7.33	24.670	626.6	3.27	27	E. S. E.	0.5	None	
13	do	9 p. m.	42.7	35.8	5.94	2.11	3.83	24.522	622.8	3.06	44	N. W.	0.5	None	
14	do	Sunrise.	29 0					24.476	621.7				0	None	
14	Between stations 10 and 11.	9 a. m.	51.0	39.6	10.55	4.22	6.33	24.330	618.0	2.40	26	S. W.	1	Cirrus, 1	
14	At station E.	12 m.	65.0	45.3	18.33	7.39	10.94	24.228	615.4	1.11	7	S. W.	3	Cirrus, 2	
14	Camp 64	3 p. m.	67.1	46.2	19.50	7.89	11.61	24.068	611.3	0.95	6	S. W.	2	Cirrus, 6	
14	do	Sunset	61.8	46.5	16.55	8.05	8.50	24.056	611.0	2.93	21	W.	1	Cirrus, 7	
15	Between stations 13 and 14.	1 p. m.	64.5	44.0	18.05	6.67	11.38	24.030	610.3	0.50	4	W.	1	Cirrus, 5	
15	Camp 65	3 p. m.	64.0	44.8	17.78	7.11	10.67	23.956	608.5	1.13	7	W.	1	Cirrus, 4	
15	do	9 p. m.	37.8	34.0	3.22	1.11	2.11	23.900	607.0	3.37	64		0	None	
16	Between stations 13 and 14	12 m.	61.3	42.0	16.28	5.55	10.73	23.688	601.7	0.32	3	S.	1	Cirrus, 1	
16	Camp 66	3 p. m.	60.7	41.6	15.94	5.33	10.61	23.208	589.5	0.33	2	S. W.	1	Cirrus, 1	
16	do	Sunset	51.5	45.0	10.83	7.22	3.61	23.180	588.8	5.43	56		0	Cirrus, 3	
16	do	9 p. m.	28.0	18.0	—2.22	—7.78	5.56	23.170	588.5				0	None	
17	Camp 67	12 m.	51.0	39.0	10.55	3.89	6.66	22.660	575.6	2.07	22	N.	1	Cirrus, 0.05	A few flakes of snow fell to-day.
17	do	3 p. m.	52.3	41.5	11.28	5.28	6.00	22.582	573.6	3.08	30	N.	1	Cumulus, 6	
17	do	Sunset	47.1	39.1	8.39	3.94	4.45	22.591	573.8	3.40	42		0	Cumulus, 6	
17	do	9 p. m.	31.0	27.8	—0.55	—2.33	1.78	22.594	573.9	2.92	70		0	Cir.-eum., 7	
18	Station 3, road survey.	9 a m.	29.8	29.0	—1.22	—1.67	0.45	22.512	571.8	4.82	92	N.	1	Cir.-eum., 6	A light cloud scudded across the sky at about noon, bearing a

18	Sta. 16, Rd. survey	12 m.	47.3	40.9	8.50	4.94	3.56	22.632	574.9	4.34	55	0	Cir-eum., 5	momentary squall. It soon passed away, and the weather became delightful as before.
18	Sta. 27, Rd. survey	3 p. m.	49.5	41.3	9.72	5.16	4.56	22.914	582.0	3.89	44	0	Cumulus, 6	
18	Bet. stas. 31 and 32	6 p. m.	45.0	36.0	7.22	2.22	5.00	23.082	586.3	2.40	32	0	Cir.-cum., 4	
18	Camp 68	9 p. m.	36.0	28.0	2.22	—2.22	4.44	23.075	586.1	1.55	32	0	Cirrus, 6	
19	P, Rd. survey	9 a. m.	40.0	30.0	4.44	—1.11	5.55	23.170	588.5	1.31	21	N 0.5	Cirrus, 6	
19	Sta. 6, Rd. survey	12 m.	48.5	39.0	9.16	3.89	5.27	23.253	590.6	2.89	34	W 2	Cirrus, 4	
20	Camp 69	9 a. m.	37.2	34.0	2.89	1.11	1.78	23.693	601.8	3.92	72	S.E. 0.5	None	
20	Station 4	12 m.	57.5	48.0	14.16	8.89	5.27	23.908	607.2	4.32	45	0	None	
20	Camp 70	Sunset	52.7	42.0	11.50	5.55	5.95	24.005	609.7	3.24	33	0	Cirrus 2,	At night wind rose with the moon and blew very strong from the E.
21	do	9 a. m.	38.0	34.0	3.33	1.11	2.22	24.100	612.1	3.66	63	N 1	None	Much wind, and the night cold.
21	do	12 m.	68.0	50.0	20.00	10.00	10.00	24.110	612.4	3.13	18	0	None	Morning clear.
21	do	3½ p. m.	66.5	48.0	19.16	8.89	10.27	24.074	611.5	2.37	14	0	None	
21	do	Sunset	56.3	44.0	13.50	6.67	6.83	24.058	611.0	3.23	28	0	None	
22	do	12 m.	64.8	47.5	18.22	8.61	9.61	24.044	610.7	2.59	16	0	None	
22	do	3 p. m.	66.9	47.0	19.39	8.33	11.06	23.994	609.4	1.45	9	0	None	
22	do	Sunset	58.9	37.5	14.94	3.05	11.89	23.970	608.8	(*)	(*)	W 0.5	None	(*) Inappreciable.
23	do	12 m.	64.3	45.5	17.94	7.50	10.44	23.988	609.3	1.47	9	W 1	None	Atmosphere smoky.
23	do	3 p. m.	69.5	47.0	20.83	8.33	12.50	23.976	609.0	(*)	(*)	W 0.5	None	(*) Inapprcciable.
23	do	Sunset	60.5	43.0	15.83	6.11	9.72	23.962	608.6	1.22	9	0	None	
23	do	9 p. m.	32.5	30.0	0.28	—1.11	1.39	23.936	608.0	3.51	78	N.E. 0.5	None	Bright meteor seen to-night in the south.
24	do	9 a. m.	44.5	32.5	6.94	0.28	6.66	24.020	610.1	0.72	9	E 0.5	None	Wind rose last night with the moon; decreased very shortly after sunrise.
24	do	12 m.	70.5	49.0	21.39	9.44	11.95	24.037	610.5	1.08	6	0	None	
24	do	3 p. m.	67.5	46.5	19.72	8.05	11.67	24.004	609.7	1.01	6	N.W. 0.5	None	
24	do	6 p. m.	58.5	42.8	14.72	6.00	8.72	23.980	609.1	1.77	15	N 0.5	None	
24	do	9 p. m.	36.0	32.5	2.22	0.28	1.94	23.964	608.7	2.53	67	N.E. 1	None	Atmosphere smoky.
25	do	9 a. m.	36.9	30.5	2.72	—0.83	3.55	23.984	609.2	2.29	44	N.E. 2	None	Wind rose last night with the moon, but died away entirely before 10 a. m. Atmosphere very clear.
25	do	12 m.	60.8	42.0	16.00	5.55	10.45	24.022	610.1	0.54	3	W 1	Cirrus 1.5	
25	do	3 p. m.	62.7	43.6	17.05	6.44	10.61	23.966	608.7	0.85	6	0	None	
25	do	6 p. m.	54.5	43.7	12.50	6.50	6.00	23.944	608.2	3.6	34	0	Cir.-cum., 7	
25	do	9 p. m.	31.0	29.0	—0.55	—1.67	1.12	23.928	607.7	3.45	80	E.N.E. 0.5	None	
26	do	Sunrise.	26.5					23.912	607.3			N.E. 3	Cir.-cum., 6	
26	do	9 a. m.	43.8	32.5	6.55	0.28	6.27	23.964	608.7	0.96	13	N.E. 2	Cumulus, 3	
26	Sta. 1, Rd. survey	12. 20 m.	58.4	44.9	14.67	7.16	7.51	23.937	608.0	3.05	25	N.E. 0.5	None	
26	Camp 71	3 p. m.	59.0	46.5	15.00	8.05	6.95	23.946	608.2	3.86	31	0	Cirrus-stratus, 8	Appearances of snow.
26	do	Sunset	54.0	45.0	12.22	7.22	5.00	23.934	607.9	4.60	43	0	Cirrus-cum., 8	Do do.
26	do	9 p. m.	48.5	38.0	9.16	3.33	5.83	23.962	608.6	2.33	27	S.W. 2	Snow-clouds, 8	Do do.

November 19.—The wind last night blew forcibly for awhile. The morning was cold, with a stiff breeze from the west, but the sun's rays soon created a pleasant temperature. At 8 p. m. the strong west wind suddenly veered around, becoming milder and more pleasant. At 9 p. m. a gentle breeze sprang up.

November 20.—A slight breeze continued blowing from the east until noon, when it was reversed, and came from the west. At 3 p. m. it ceased, and a breathless calm reigned over the evening. The day warm and delightful; the night cool, but pleasant.

November 22.—The weather for some time has remained nearly the same for each successive day; uncomfortably warm at midday, calm and pleasant towards evening, and until 9 p. m.; then arises a strong breeze which blows in gusts during the night, and until 10 a. m. the next day. Towards morning the air becomes excessively cold. The skies are cloudless and brilliant both day and night.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches.	In millimet's			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.									
1853.			°	°	°	°	°								
Nov 27	Camp 71	12 m.	42.0	40.8	5.55	4.89	0.66	23.845	605.6	6.06	91		0	Nimbus, 10	A cold storm of rain commenced last evening, and ended at 10 a. m. Thick fog at 9 p. m. Dew was observed last night.
27	do	3 p. m.	49.0	46.2	9.44	7.89	1.55	23.820	605.0	7.00	81		0	Nimbus, 9	
27	do	Sunset	42.0	41.0	5.55	5.00	0.55	23.816	604.9	6.20	94		0	Cumulus, 9	
27	do	9 p. m.	35.5	35.5	1.94	1.94	0.00	23.798	604.4	5.31	100		0		
28	do	Sunrise.	32.5	31.0	0.28	—0.55	0.83	23.900	607.1	3.91	85		0	Cirrus, 8	Brilliant meteor last evening, commencing in the N.E. at an angle of near 40°, and disappearing near Polaris. Very heavy white frost during the night.
28	do	9 a. m.	33.3	32.5	0.72	0.28	0.44	23.928	607.7	4.50	92		0	Cumulus,	
28	Station M	3 p. m.	46.5	41.5	8.05	5.28	2.77	24.000	609.6	5.02	65	N.E	0.2	None	
28	Camp 72	Sunset	58.5	43.5	14.72	6.39	8.33	23.989	609.3	2.19	18		0	None	
28	do	9 p. m.	36.0	34.0	2.22	1.11	1.11	24.004	609.7	4.32	82		0	None	
29	do	Sunrise.	35.0	31.5	1.67	—0.28	1.95	24.040	610.6	3.36	67	W	0.5	Cirrus, 3	
29	do	9 a. m.	44.8	39.5	7.11	4.16	2.95	24.046	610.7	4.39	60		0	Cirrus, 9	
29	Sta. 8, Rd. survey	12 m.	52.0	46.3	11.11	7.94	3.17	24.029	610.3	6.06	63		0	Cirrus, 9	
30	Camp 73	Sunrise.	30.0									W	0.5	None	131 observations give 52°.5 Fah. for the mean temperature during the month of November. The highest temperature observed is 82.4; the lowest 23° Fahrenheit. Atmosphere very clear.
30	do	9 a. m.	53.8	45.5	12.11	7.50	4.61	24.391	619.5	4.98	47		0	None	
30	Sta. C, Rd. survey	12 m.	50.0	42.3	10.00	5.72	4.28	24.490	622.0	4.33	46	S.W.	0.5	Cirrus, 1	
30	Camp 74	3 p. m.	56.0	52.0	13.33	11.11	2.22	24.660	626.4	8.53	75		0	None	
30	do	Sunset	53.0	45.8	11.67	7.67	4.00	24.648	626.0	5.42	53		0	None	
30	do	9 p. m.	36.3	35.5	2.39	1.94	0.45	24.615	625.2	5.04	93		0	None	
Dec. 1	do	Sunrise.	21.0	20.5	—6.11	—6.39	0.28	24.610	625.1	2.66	100		0	None	Very heavy frost last night. Since leaving the base of the Sierra Madre the winds have ceased, the atmosphere has been generally clear, and the temperature mild during the latter part of the day and in the evening.
1	do	9 a. m.	41.5					24.670	626.6			N.E.	0.5	None	
1	Sta. C, Rd. survey	12 m.	56.3	49 0	13.50	9.44	4.06	24.771	629.2	6.39	56		0	None	
1	Sta. L, Rd. survey	3 p. m.	59.5	48.0	15.28	8.89	6.39	24.624	625.4	4.70	37		0	None	
1	Camp 75	Sunset	59.3	46.7	15.17	8.16	7.01	24.733	628.2	3.89	30		0	None	
1	do	9 p. m.	34.7	34.0	1.50	1.11	0.39	24.682	626.9	4.40	96		0	None	
2	do	Sunrise	24.5					24.722	627.9				0	None	The weather is becoming daily milder. The skies are cloudless. Brilliant meteors are frequently seen lighting the sky at night.
2	do	9 a. m.	42.5	41.0	5.83	5.00	0.83	24.762	628.9	6.03	88		0	None	
2	Sta. B, Rd. survey	12 m.	53.7	46.3	12.05	7.94	4.11	24.608	625.0	5.49	54	N	1	Cirrus, 2	
2	Sta. K, Rd. survey	3 p. m.	60.9	49.0	16.06	9.44	6.62	24.657	626.3	4.84	36		0	Cirrus, 0.5	
2	Camp 76	Sunset	59.5	50.0	15.28	10.00	5.28	24.775	629.3	5.97	47		0	None	
2	do	9 p. m.	38.3	38.3	3.50	3.50	0.00	24.736	628.3	5.89	100		0	None	
3	do	Sunrise	26.3					24.698	627.5				0	Cirrus, 3	
3	Station P	12 m.	59.5	49.5	15.28	9.72	5.56	25.035	635.9	5.65	44		0	Cirrus, 3	Very hazy in S.W.

3	Sta. 7, Rd. survey	3 p. m	64.0	48.9	17.78	9.39	8.39	24.959	633.9	3.73	25		0	Cirrus, 4
3	Station Z	Sunset	54.0	50.0	12.22	10.00	2.22	25.076	636.9	7.84	74		0	Cirrus, 5
3	Camp 77	9 p. m	32.3	30.0	0.17	—1.11	1.28	25.068	636.7	3.55	79		0	None
4	----do	Sunrise	25.0					25.032	635.8				0	Cirrus, 2
4	----do	9 a. m	44.3	40.5	6.83	4.72	2.11	25.100	637.5	5.13	70		0	Cirrus, 5
4	----do	Sunset	73.3	52.8	22.94	11.55	11.39	25.054	636.3	3.27	15		0	Cirrus, 1
4	----do	9 p. m	31.3					24.996	634.9				0	None
5	----do	Sunrise	19.5					25.000	635.0				0	None
5	----do	9 a. m	38.0	31.5	3.33	—0.28	3.61	25.051	636.3	2.42	43		0	None
5	Camp 78	3 p. m	65.2	47.8	18.44	8.78	9.66	25.180	639.6	2.66	16	E. N. E.	0.5	None
5	----do	Sunset	58.2	46.0	14.55	7.78	6.77	25.182	639.6	3.82	32		0	None
6	----do	Sunrise	20.2					25.248	641.3				0	None
6	----do	9 a. m	39.0	33.0	3.89	0.55	3.34	25.315	643.0	2.78	48		0	None
6	Station 8	3 p. m	59.3	43.0	15.17	6.11	9.06	25.353	643.9	1.62	13	S.W	0.5	None
6	Station E	Sunset	51.3	41.8	10.73	5.44	5.29	25.378	644.6	3.59	38		0	None
6	Camp 79	9 p. m	27.3					25.432	646.0				0	None
7	----do	9 a. m	36.7	30.5	2.61	—0.83	3.44	25.474	647.0	2.32	46		0	None
7	Station B	12 m	56.5	45.7	13.61	7.61	6.00	25.504	647.8	4.19	36		0	None
7	Camp 80	3 p. m	64.2	42.3	17.89	5.72	12.17	25.557	649.1	(*)	(*)		0	None
7	----do	Sunset	50.8	43.0	10.44	6.11	4.33	25.510	647.9	4.45	48	N	0.5	None
7	----do	9 p. m	25.5					25.449	646.4				0	None
8	----do	Sunrise	15.0					25.405	645.3				0	Cirrus, 9
8	----do	9 a. m	26.8	23.8	2.89	—4.55	1.66	25.434	646.0	2.36	66		0	Cirrus, 7
8	Station 6	12 m	56.3	43.0	13.50	6.11	7.39	25.448	646.4	2.70	23		0	Cirrus, 6
8	Camp 81	3 p. m	55.9	42.0	13.28	5.55	7.73	25.388	644.8	2.17	19		0	Cirrus, 8
8	----do	Sunset	44.0	38.0	6.67	3.33	3.34	25.342	643.7	3.87	53		0	Cirrus, 8
8	----do	9 p. m	30.6	30.6	—0.78	—0.78		25.284	642.2	4.33	100		0	Cirrus, 7
9	----do	Sunrise	27.5					25.176	639.5				0	Cir. & cum., 10.
9	----do	9 a. m	32.5	30.5	0.28	—0.83	1.11	25.194	639.9	3.67	81		0	Cum.-strat., 9.
9	Camp 82	12 m	52.9	43.1	11.61	6.17	5.44	25.190	639.8	3.82	37		0	Cir.-strat., 9
9	----do	3 p. m	64.3	51.0	17.94	10.55	7.39	25.129	638.3	5.02	33		0	Cir.-cum., 5
9	----do	Sunset	55.3	42.5	12.94	5.83	7.11	25.102	637.6	2.68	24		0	Cirrus, 4
9	----do	9 p. m	43.1	39.8	6.17	4.33	1.84	25.113	637.8	5.13	73	E.	0.5	Cirrus, 4

Atmosphere very clear.	
The day bright and calm.	
Atmosphere smoky.	
(*) Inappreciable.	

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches.	In millimet's			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.									
1853.			°	°	°	°	°								
Dec. 10	Camp 83	Sunrise	33.0	32.5	0.55	0.28	0.27	25.110	637.8	4.51	96	S.E.	1	Cirrus, 7	
10	do	9 a. m	44.0	40.5	6.67	4.72	1.95	25.132	638.3	5.22	74	S.E.	1	Cir.-cum.-strat., 8	
10	do	12 m.	49.8	43.1	9.89	6.17	3.72	25.128	638.2	4.85	54	N.N.E.	3	Cir.-cum.-strat., 9	
10	do	3 p. m	59.9	45.3	15.50	7.39	8.11	25.063	636.6	2.80	22	S.W	3	Cir.-cum.-strat., 9	
10	do	Sunset	53.0	41.6	11.67	5.33	6.34	25.084	637.1	2.90	29	S	4	Cir.-cum.-st., 10	
10	do	9 p. m	49.5	40.0	9.72	4.44	5.28	25.068	636.7	3.01	35	N.E	2	Cir.-cum., 4	
11	do	Sunrise	43.8	40.1	6.55	4.50	2.05	25.076	636.9	5.07	70	N.E	2	Cir.-cum., 7	
11	do	9 a. m	49.9	43.8	9.94	6.55	3.39	25.146	638.7	5.22	57	E	2	Cir.-cum., 7	
11	do	12 m.	59.0	47.1	15.00	8.39	6.61	25.153	638.9	4.26	34	S	0.5	Cir.-cum., 8	
11	do	3 p. m	52.3	45.6	11.28	7.55	3.73	25.151	638.8	5.52	56	N	0.5	Cir.-cum., 10	
11	do	Sunset	49.2	43.8	9.56	6.55	3.01	25.170	639.3	5.47	61		0	Cumulus, 9	
11	do	9 p. m	42.6	40.5	5.89	4.72	1.17	25.228	640.8	5.69	85		0	Cir.-cum., 9	
12	do	Sunrise	38.0	36.5	3.33	2.50	0.83	25.260	641.6	5.01	86	W	0.5	Nimbus, 1	
12	do	9 a. m	38.5	37.0	3.61	2.78	0.83	25.260	641.6	5.12	86	N	0.5	Cir.-st.-nim., 10	
12	do	12 m	47.8	44.8	8.78	7.11	1.67	25.241	641.1	6.54	78		0	Cumulus, 8	
12	do	3 p. m	50.0	47.5	10.00	8.61	1.39	25.134	638.4	7.53	81	N.W	0.5	Cir.-cum.-st., 10.	
12	do	Sunset	47.8	43.7	8.78	6.50	2.28	25.096	637.4	5.88	70	N.W	0.5	Cir.-cum.-st., 10.	
12	do	9 p. m	42.0	40.5	5.55	4.72	0.83	25.092	637.3	5.89	88	N	2	Cumulus, 8	
13	do	Sunrise	42.0	41.0	5.55	5.00	0.55	25.050	636.2	6.20	94	N	0.5	Cumulus, 9	
13	do	9 a. m	43.5	42.2	6.39	5.66	0.73	25.058	636.4	6.42	91	S	0.5	Cir.-cum.-stra., 10	
13	do	12 m.	60.8	50.0	16.00	10.00	6.00	25.052	636.3	5.54	41		0	Cumulus, 7	Slight shower of hail & rain, 1 p. m.
13	do	3 p. m	59.2	46.5	15.11	8.05	7.06	24.990	634.7	3.80	30	S.W.	4	Cumulus, 8	Slight shower of rain at 2 p. m.
13	do	Sunset	47.6	42.9	8.66	6.05	2.61	24.972	634.3	5.45	65	S.W.	2	Cumulus, 9	
13	do	9 p. m	40.0	38.5	4.44	3.61	0.83	25.004	635.1	5.43	87	S.W.	2	Cumulus, 10	Showery during first part of the night; amount of rain 0.23 in.
14	do	Sunrise	30.8					25.024	635.6			N	0.5	Cumulus, 3.	
14	do	9 a. m	44.5	40.5	6.94	4.72	2.22	25.062	636.6	5.06	68	N	0.5	Cumulus, 3	
14	Station 4, Rd. surv.	12 m.	42.0	38.5	5.55	3.61	1.94	25.060	636.5	4.77	72	S	2	Cumulus, 8	
14	Camp 83	3 p. m	44.0	40.1	6.67	4.50	2.17	25.058	636.5	5.00	70	S.W.	5	Cumulus, 4	
14	do	Sunset	36.0	34.9	2.22	1.61	0.61	25.052	636.3	4.81	89	S.W.	2	Cumulus, 3	
14	do	9 p. m	28.5	28.0	—1.94	—2.22	0.28	25.062	636.6	3.75	96	W	0.5	Cirrus, 8	
15	do	Sunrise	25.0					25.030	635.7				0	Cirrus, 5	
15	do	9 a. m	37.4	32.0	3.00	0.00	3.00	25.073	636.8	2.82	50	N.N.W.	0.5	Cirrus, 4	

15	----do----------	12 m.----	43.7	39.5	6.50	4.16	2.34	25.058	636.5	4.76	67	N.N.W.	1	Cir. & Cum , 7 --	Commeneed snowing at 1 p. m.;
15	----do----------	3 p. m---	33.0	32.0	0.55	0.00	0.55	25.052	636.3	4.27	92	N -----	2	Cir. & Cum., 10 -	continued until 3.15 p.m.; quan-
15	----do--- --------	Sunset.---	33.0	31.5	0.55	—0.28	0.83	25.094	637.4	4.04	85	--------	0	Cir.-cum.-stra., 5	tity too small to be measured.
15	----do----------	9 p. m---	30.2	29.5	—1.00	—1.39	0.39	25.132	638.3	3.92	92	--------	0	Cumulus, 5-----	
16	----do----------	9 a. m---	37.5	32.0	3.05	0.00	3.05	25.232	640.9	2.79	50	--------	0	Cirrus, 1 -------	Heavy frost during the night.
16	Station 2, Rd. surv.	12 m.----	35.0	34.1	1.67	1.17	0.50	25.344	643.7	4.71	93	N.N.W.	1	Cir.-cum., 2 ----	
16	Camp 84 ---------	3 p. m---	40.2	34.9	4.55	1.61	2.94	25.328	643.3	3.43	55	N .----	2	Cirrus, 3 -------	Thick haze near the horizon.
16	----do----------	Sunset.---	31.9	------	------	------	------	-------	------	------	----	--------	0	Cirrus, 1 -------	
17	----do----------	9 a. m---	31.0	------	------	------	------	25.422	645.7	------	----	--------	0	None ----------	Hazy.
17	Camp 85 ---------	Sunset.---	46.5	42.0	8.05	5.55	2.50	25.419	645.6	5.31	66	--------	0	None ----------	
17	----do----------	9 p. m---	21.9	------	------	------	------	25.372	644.4	------	----	--------	0	Nonc ----------	
18	----do----------	9 a. m---	31.0	31.0	—0.55	—0.55	0.00	25.442	646.2	4.42	100	S.S.E --	0.5	Cirrus, 8 -------	
18	----do----------	10 a. m--	34.0	30.9	1.11	—0.61	1.72	25.456	646.6	3.15	69	S.S.E --	0.5	Cirrus, 7 -------	
18	----do----------	11 a. m--	39.3	31.5	4.05	—0.28	4.33	25.456	646.6	2.10	36	E.S.E --	0.5	Cirrus, 7 -------	
18	----do----------	12 m.----	48.2	39.5	9.00	4.16	4.84	25.448	646.4	3.27	38	S.S.E --	0.5	Cirrus, 6 -------	
18	----do----------	1 p. m---	49.5	42.6	9.72	5.89	3.83	25.435	646.0	4.68	52	E.-----	0.5	Cirrus, 7 -------	
18	----do----------	2 p. m---	51.0	41.0	10.55	5.00	5.55	25.424	645.7	3.21	35	S.S.E --	0.5	Cirrus, 6-------	
18	----do----------	3 p. m---	53.9	43.9	12.16	6.61	5.55	25.430	645.9	3.97	38	--------	0	Cirrus, 5-------	
18	----do----------	4 p. m---	41.5	38.6	5.28	3.66	1.62	25.416	645.5	4.98	74	--------	0	Cirrus, 7-------	
18	----do----------	Sunset---	38.5	34.0	3.61	1.11	2.50	25.399	645.1	3.49	60	--------	0	Cirrus, 6-------	
18	----do----------	6 p. m---	30.5	27.0	—0.83	—2.78	1.95	25.386	644.8	2.68	65	--------	0	Cirrus, 2-------	
18	----do----------	7 p. m---	29.0	------	------	------	------	25.389	644.9	------	----	--------	0	Cirrus, 2-------	
18	----do----------	8 p. m---	22.0	------	------	------	------	25.394	645.0	------	----	--------	0	Cirrus, 2-------	
19	----do----------	9 a. m---	23.3	------	------	------	------	25.426	645.8	------	----	--------	0	Cirrus, 8-------	In the morning, stratus clouds
19	Station A---------	12 m.----	36.0	32.5	2.22	0.28	1.94	25.412	645.4	3.53	67	--------	0	Cirrus, 3-------	covered the sky and obseured
19	Camp 86.---------	3 p. m---	40.9	35.8	4.94	2.11	2.83	25.344	643.7	3.65	56	--------	0	Cirrus, 6-------	the sun, and there was a light
19	----do----------	6 p. m---	35.2	30.1	1.78	—1.06	2.84	25.324	643.2	2.70	53	--------	0	Cirrus, 8-------	breeze from the S.E. The day
19	----do----------	9 p. m---	20.5	------	------	------	------	25.284	642.2	------	----	--------	0	Cirrus, 1-------	remained cloudy ; a cool breeze
															continuing from the east. The
															evening was calm and clear.

December 10.—The sky has been covered to-day with black, lowering clouds; a raw wind steadily blowing. At night, soon after the moon appeared, white, fleecy, cirro-cumulus clouds arose from the southwest, but passing rapidly, left the sky nearly clear. A stiff breeze continued unabated during the whole evening, and, although no clouds were visible, the storm still threatened. The barometer remained low, from three to four-tenths of an inch less than at previous camps in the valley of the river. The temperature has been mild; the wind variable, with no great force till night, when it blew in gusts. Appearances of snow during the entire day—increased towards dark. Two brilliant meteors seen this evening.

December 11.—The sky has been covered with black, threatening clouds, which at noon produced a few drops of rain, ending with a slight pattering of hail. A breath of air has occasionally broken the calm of the day. Several showers occurred in the evening, but very light. The moon, however, as usual, scattered the clouds for awhile, but at 8½ p. m. appeared veiled in a light mist forming a faint corona. At 3½ p. m. distant thunder. Appearances of rain.

December 12.—Light showers continued during the morning. At noon the sun came out for a moment, but soon retired behind clouds, and was seen no more during the day. At night the moon appeared, but shrouded by cirrus clouds, and unattended by stars. The barometer rose this morning to 25.26, but fell again in the evening. At 10 p. m. rain; quantity, .006.

December 14.—Last night there was a fall of snow; towards morning the sky became serene and clear. During the latter part of the day there has been a stiff southerly breeze coming from the Mogoyon mountain. At sunset, wind from the west brought a slight snow-storm from Sierra San Francisco, about thirty-five miles distant. Clouds then flitted past the moon as before, producing coronæ of beautiful tints. Once the moon, scarcely passed the full, appeared in the centre of a circle of 5° radius, while at the same time it formed upon the clouds beyond an ellipse of rainbow hues, of which it occupied one focus. Afterwards, the clouds being slightly broken, the halo assumed the form of an equilateral triangle—the tints remaining the same. The form seemed perfect, and was noticed by many in camp; but shortly the circle was re-formed. At 8½ p. m. a breeze came from the east; but clouds continued, as before, forming on Sierra San Francisco and rapidly overspreading the sky.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Dry bulb t'.		In inches.	In millimet's			Direction.	Force.		
1853.			°	°	°	°	°								
Dec. 20	Camp 86	9 a. m	30.0					25.326	643.3				0	Cirrus, 4	Since morning, clouds and cirro-stratus have been flying toward the east, and a fresh westerly breeze blowing.
20	Camp 87	12 m.	57.0	45.6	13.89	7.55	6.34	25.322	643.2	3.96	34		0	Cumulus, 3	
20	----do	3 p. m	55.2	42.5	12.89	5.83	7.06	25.312	642.9	2.72	24	S. W.	3	Cir.-eum., 5	
20	----do	Sunset	42.0	36.5	5.55	2.50	3.05	25.314	643.0	3.68	55		0	Cir.-eum., 5	
20	----do	9 p. m	34.0	32.5	1.11	0.28	0.83	25.314	643.0	4.18	85	S. W	1.8	Cirrus, 3	
21	----do	Sunrise	27.5									S. W	0.5	Cir.-strat., 6	The day cool, with a stiff breeze from the S.W.; clouds flying before the wind, keeping the San Francisco peaks generally enveloped in a storm.
21	----do	9 a. m	34.8	31.8	1.56	—0.11	1.67	25.318	643.1	3.48	72	S	1	Cumulus, 6	
21	----do	12 m.	54.6	42.1	12.55	5.61	6.94	25.264	641.7	2.68	25	W	4	Cir.-eum., 4	
21	----do	3 p. m	52.0	41.8	11.11	5.44	5.67	25.274	641.9	3.36	36	S. W	4	Cir.-eum., 5	
21	----do	Sunset	45.8	37.3	7.67	2.94	4.73	25.278	642.0	2.85	38	S. W	3	Cumulus, 4	
21	----do	9 p. m	39.5	35.7	4.16	2.06	2.10	25.268	641.8	4.07	67	S. W	1	Cirrus, 2	
22	----do	Sunrise	27.5					25.250	641.3				0	Cir.-eum., 7	Storms surrounded us during the day. The night dark, mild, and ealm; a light snow falling.
22	Camp 88	Sunset	39.9	37.4	4.39	3.00	1.39	25.108	637.7	4.86	80	W	2	Cumulus, 10	Snowing slightly.
22	----do	7.25 p. m.	37.8	36.2	3.22	2.33	0.89	24.665	626.5	4.91	86		0	Cumulus, 9	
23	----do	Sunrise	30.0	30.0	—1.11	—1.11	0.00	24.728	628.1	4.24	100	N	2	Cumulus, 10	
24	Camp 89	9½ a. m	36.7	33.5	2.61	0.83	1.78	24.039	610.6	3.79	72		0	Cirrus, 4	Last night at 10 o'clock the Fahrenheit thermometer stood at 3½° above zero.
24	----do	12 m	51.6	39.0	10.89	3.89	7.00	24.005	609.7	1.86	18		0	Cirrus, 5	
24	----do	3 p. m	53.8	40.0	12.11	4.44	7.67	23.962	608.6	1.68	16		0	Cirrus, 7	
24	----do	Sunset	34.9	32.0	1.61	0.00	1.61	23.928	607.7	3.65	71	N. W	0.5	Cirrus, 3	
25	----do	9 a. m	33.0					24.050	610.8				0	Cirrus, 6	
25	----do	12 m	39.0	34.3	3.89	1.28	2.61	24.048	610.8	3.49	57		0	Cirrus, 5	
25	----do	3 p. m	46.2	39.0	7.89	3 89	4.00	24.028	610.3	3.65	46		0	Cirrus, 7	
25	----do	Sunset	37.0	34.3	2.78	1.28	1.50	24.012	609.9	4.16	79		0	Cirrus, 9	
26	----do	9 a. m	26.0	24.0	—3.33	—4.44	1.11	24.080	611.6	2.69	78		0	None	The day rather chilly, but the night mild. A mist passed over the sky, obscuring the stars.
26	Camp 90	Sunset	40.3	36.0	4.61	2.22	2.39	23.482	596.4	3.95	62	S.W	1	Cumulus, 2	
26	----do	9 p. m	36.3	33.6	2.39	0.89	1.50	23.510	597.2	3.98	75	W	2	Cumulus, 6	
27	----do	Sunrise	30.0	29.0	—1.11	—1.67	0.56	23.528	597.6	3.75	92	W	0.5	Cirrus-eum., 1	
27	----do	9 a. m	33.2	32.0	0.67	0.00	0.67	23.567	598.6	4.20	88		0	Cumulus, 9	
27	Camp 91	9 p. m	30.2					23.028	584.9				0	Cirrus, 3	

28	----do----------	Sunrise --	23.5	------	------	------	------	23.006	584.3	------	----	--------	0	Cirrus, 1 -------	Atmosphere smoky. The day clear and warm, considerably diminishing the depth of snow. The night mild, but cloudy, seeming to threaten rain.
28	----do----------	12 m-----	71.0	53.2	21.67	11.78	9.89	23.008	584.4	4.35	22	--------	0	Cirrus, 1 -------	
28	----do----------	3 p. m---	51.6	45.9	10.89	7.72	3.17	22.964	583.3	5.95	62	W------	0.8	Cirrus, 7 -------	
28	----do----------	Sunset ---	42.7	34.7	5.94	1.50	4.44	22.939	582.6	2.50	36	--------	0	None ----------	
28	----do----------	9 p. m---	45.3	37.3	7.39	2.94	4.45	22.938	582.6	3.03	40	N ------	2	Snow-clouds, 10-	
29	----do----------	Sunrise --	37.5	36.3	3.05	2.39	0.66	22.854	580.5	5.05	89	N. W --	1	Nimbus, 10------	
29	----do----------	9 a. m ---	39.5	37.2	4.16	2.89	1.27	22.886	581.3	4.90	81	--------	0	Nimbus, 10------	
29	----do----------	12 m-----	45.2	41.2	7.33	5.11	2.22	22.844	580.2	5.26	69	W------	1	Cir.-eum., 4 ----	
29	----do----------	3 p. m---	45.9	38.7	7.72	3.72	4.00	22.811	579.4	3.59	45	N. W --	2	Cirrus, 4 -------	
29	----do----------	Sunset ---	38.7	33.5	3.72	0.83	2.89	22.814	579.6	3.14	54	S.W ---	2	Cirrus, 3 -------	
29	----do----------	9 p. m---	29.5	------	------	------	------	22.828	579.8	------	----	S.W ---	2	Cirrus, 3 -------	
30	----do----------	9 a. m ---	31.0	------	------	------	------	22.852	580.4	------	----	N.N.W.	3	Cirrus, 1 -------	
30	----do----------	12 m-----	49.0	45.6	9.44	7.55	1.89	22.898	581.6	6.63	76	N.N.W.	1	None ----------	
30	----do----------	3 p. m---	35.0	33.9	1.67	1.06	0.61	22.914	582.0	4.59	89	W------	2	None ----------	
30	----do----------	Sunset ---	25.6	------	------	------	------	22.920	582.1	------	----	W------	0.5	None ----------	
31	----do----------	9 a. m ---	39.5	37.5	4.16	3.05	1.11	23.054	585.5	5.04	83	--------	0	None ----------	Atmosphere smoky. The day clear and pleasant, with light breezes occasionally from the east. The snow yielded quite sensibly to the sun's bright rays.
31	Camp 92 ---------	3 p. m---	44.5	41.9	6.94	5.50	1.44	23.013	584.5	5.93	79	E.------	0.5	None ----------	
31	----do----------	Sunset ---	34.8	29.0	1.56	—1.67	3.23	22.980	583.7	2.26	49	E.------	1	Cirrus, 3 -------	
31	----do----------	9 p. m---	30.2	28.0	—1.00	—2.22	1.22	23.026	584.9	3.30	77	E.------	0.5	None ----------	
1854.															
Jan. 1	----do----------	Sunrise --	29.0	------	------	------	------	23.048	585.4	------	----	N. W --	0.5	Cirrus, 3 -------	
1	----do----------	9 a. m ---	41.0	33.5	5.00	0.83	4.17	23.086	586.4	2.37	38	S.W ---	2	None ----------	
1	Camp 93 ---------	Sunset ---	36.2	32.8	2.33	0.44	1.89	23.166	588.4	3.61	68	N ------	0.5	Stratus, 3 ------	
1	----do----------	9 p. m---	33.9	32.0	1.06	0.00	1.0	23.140	587.8	3.97	81	N ------	0.3	None ----------	
2	----do----------	Sunrise --	24.0	------	------	------	------	23.144	587.9	------	----	N. W --	0.5	Stratus, 4 ------	
2	----do----------	9 a. m ---	41.6	35.5	5.33	1.94	3.39	23.190	589.0	3.30	51	--------	0	Stratus, 8 ------	
2	Camp 94 ---------	3 p. m---	50.0	42.9	10.00	6.05	3.95	23.704	602.1	4.65	52	--------	0	Stratus, 6 ------	
3	----do----------	Sunrise --	------	------	------	------	------	23.632	600.2	------	----	--------	0	None ----------	
3	----do----------	9 a. m ---	47.5	42.0	8.61	5.55	3.06	23.642	600.5	4.98	60	--------	0	None ----------	
3	----do----------	12 m-----	61.0	44.0	16.11	6.67	9.44	23.604	599.5	1.65	12	--------	0	None ----------	
3	----do----------	3 p. m---	53.0	42.5	11.67	5.83	5.84	23.574	598.8	3.45	34	--------	0	None ----------	Atmosphere hazy.
3	----do----------	9 p. m---	33.0	33.0	0.55	0.55	0.00	23.500	596.9	4.76	100	E.------	2	None ----------	
4	----do----------	Sunrise --	30.1	------	------	------	------	23.412	594.7	------	----	E.------	1.5	Cirrus, 5 -------	
4	----do----------	9 a. m ---	38.9	38.5	3.83	3.61	0.22	23.442	595.4	5.80	97	E.------	2	Cirrus, 3 -------	
4	----do----------	12 m-----	42.4	36.0	5.77	2.22	3.55	23.370	593.6	3.28	49	E.S.E ..	2	Cir.-eum., 3 ----	
4	----do----------	3 p. m---	43.0	36.5	6.11	2.50	3.61	23.340	592.8	3.35	47	E.S.E ..	2	Cir.-eum., 3 ----	

December 27.—The sun was obscured during the day; the air mild; the sky covered by a cloud except an arch of 20° ver. sin. N.W. This blue segment singularly constant during the day. At Leroux's spring, snow about 8 inches deep.

December 29.—Slight shower of rain between 7 and 8 a. m.; too little to measure. The rain soon dwindled to a mist, which disappeared at noon; the clouds passing toward the east. A strong breeze from the N.W. rendered the atmosphere chilly and uncomfortable. The clouds threaten a storm.

December 30.—The morning clear. A cold west wind prevailed till sunset, when there was a calm. Scarcely a cloud appeared throughout the day. 155 observations give 41°.4 Fahrenheit for the mean temperature during the month of December. The highest temperature observed is 73°.3; the lowest 15° Fahrenheit.

January 1.—The sun uncomfortably warm; the snow melting rapidly. At sunset a few stratus clouds rose from the west, and at 9 p. m. the stars appeared dim through a vapory atmosphere.

January 2.—The sun rose behind thin stratus clouds that belted the sky. The day warm and pleasant, the snow having nearly disappeared. The night calm and clear.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1854.			°	°	°	°	°								
Jan. 4	Camp 94	Sunset	35.0	29.5	1.67	—1.39	3.06	23.322	592.3	2.52	49	S.S E	2	Cir.-eum., 3	
4	do	9 p. m	30.0					23.312	592.1			S.S.E	3	Cir.-eum., 2	
5	do	Sunrise	28.0					23.268	591.0			E.S.E	3	Cir.-eum., 3	
5	do	9 a. m	36.0	32.0	2.22	0.00	2.22	23.292	591.6	3.28	61	S.S.E	3	Cir.-cum., 4	
5	do	12 m	46.7	38.9	8.16	3.83	4.33	23.264	590.9	3.43	44	S.S.E	3	Cir.-eum., 8	
5	do	3 p. m	36.0	31.5	2.22	—0.28	2.50	23.244	590.4	3.15	63	S.S.E	3	Snow-clouds, 10	Commeneed snowing at 2.10 p. m.; eontinued in squalls until 4.15 p. m.
5	do	Sunset	35.0	32.0	1.67	0.00	1.67	23.272	591.1	3.61	71	E S.E	1	Cir.-stra.-nim.10-	
5	do	9 p. m	34.2	32.0	1.22	0.00	1.22	23.263	590.9	3.88	78	S.S.E	0.5	Cir.-cum., 9	
6	do	Sunrise	23.0										0	Cirrus, 10	Snowing; sky completely overclouded.
6	do	9 a. m	24.0					23,376	593.7			W	0.5	None	
6	do	12 m	30.1	27.0	—1.06	—2.78	1.72	23.388	594.0	2.81	69	W	1	Cirrus, 6	
6	do	3 p. m	28.5	27.6	—1.94	—2.44	—0.50	23.440	595.3	3.57	92	W	2	Cirrus, 6	
6	do	Sunset	22.9	22.0	—5.06	—5.55	0.49	23.482	596.4	? 2.73	?90	W	0.5	Cirrus, 1	
6	do	9 p. m	23.0					23.586	599.1			N.W	5	None	
7	do	9 a. m	34.5	34.2	1.39	1.22	0.17	23.736	602.9	4.93	100	E	0.5	Cirrus, 7	The night extremely eold, with an inereasing wind from the northeast.
7	do	12 m	43.7	36.3	6.50	2.39	4.11	23.732	602.8	3.00	42	S.E	0.5	Cirrus, 7	
7	do	3 p. m	40.5	35.8	4.72	2.11	2.61	23.717	602.4	3.78	59	S.E	0.5	Cirrus, 5	
7	do	9 p. m	25.5	25.0	—3.61	—3.89	—0.28	23.674	601.3	3.26	95	S.E	3	Cirrus, 4	
8	do	Sunrise	31.5									S.E	1	Cirrus, 9	
8	do	9 a. m	37.0	32.0	2.78		2.78	23.732	602.8	2.93	52	E	1	Cirrus, 9	
8	Camp 95	9 p. m	35.3	33.7	1.83	0.94	0.89	23.974	608.9	4.35	85		0	Cirrus, 10	
9	do	9 a. m	44.2	39.8	6.78	4.33	2.45	23.960	608.6	4.76	65		0	Cirrus, 9	
9	Camp 96	Sunset	37.8	35.5	3.22	1.94	1.28	24.362	618.8	4.55	80		0	Cir.-cum., 8	
9	do	9 p. m	29.8					24.368	618.9				0	Cir.-eum., 8	
10	do	Sunrise	28.5					24.382	619.3				0	Cir.-eum., 6	
10	do	9 a. m	34.7	31.8	1.50	—0.11	1.61	24.454	621.1	3.53	71		0	Stratus, 8	
10	Camp 97	Sunset	38.0	30.8	3.33	—0.67	4.00	25.000	635.0	2.22	36		0	Cirrus, 4	
10	do	9 p. m	26.8					24.988	634.7				0	None	
11	do	Sunrise	20.5					25.010	635.2				0	Cir.-eum., 8	Last night cold and calm. The day cloudy.
11	do	9 a. m	40.0	32.0	4.44	0.00	4.44	25.026	635.6	1.97	32		0	Cir.-eum., 7	
11	do	12 m	63.0	48.5	17.22	9.16	8.06	24.984	634.6	3.80	26		0	Cir.-cum., 9	Coronæ.

11	----do----------	3 p. m---	59.2	48.0	15.11	8.89	6.22	24.930	633.2	4.80	38	--------	0	Cir.-cum., 9----
11	----do----------	Sunset---	42.5	37.9	5.83	3.28	2.55	24.888	632.1	4.27	63	--------	0	Cir.-cum., 9----
11	----do----------	9 p. m---	27.0	------	------	------	------	24.826	630.6	------	----	--------	0	Cir.-cum., 9----
12	Camp 98---------	3 p. m---	59.9	47.2	15.50	8.44	7.06	24.904	632.5	4.02	31	--------	0	None ----------
12	----do----------	Sunset----	49.0	43.5	9.44	6.39	3.05	24.890	632.2	5.36	61	--------	0	None ----------
12	----do----------	9 p. m---	27.5	------	------	------	------	24.876	631.8	------	----	--------	0	None ----------
13	----do----------	Sunrise---	21.0	------	------	------	------	24.898	632.4	------	----	--------	0	Cirrus, 4 -------
13	Camp 99---------	Sunset----	53.0	36.2	11.67	2.33	9.34	25.171	639.3	(*)	(*)	S.E----	3	Cirrus, 8 -------
13	----do----------	9 p. m---	43.5	38.6	6.39	3.66	2.73	25.166	639.2	4.31	61	S.E----	3	Cirrus-cum., 9---
14	----do----------	Sunrise---	43.3	35.7	6.28	2.06	4.22	25.086	637.2	2.81	39	S.E----	.05	Cir. & nim., 10---
14	----do----------	9 a. m----	48.0	38.1	8.89	3.39	5.50	25.080	637.0	2.56	31	S.E----	2	Cir. & nimbus, 7-
14	----do----------	12 m.-----	51.0	36.3	10.55	2.39	8.16	25.038	635.9	0.59	7	S.E----	4	Cir.-cum.&nim.10
14	----do----------	3 p. m---	50.6	42.0	10.33	5.55	4.78	24.980	634.5	3.94	43	S.E----	4	Cir. & nimbus, 9-
15	----do----------	Sunrise---	27.0	------	------	------	------	24.928	633.1	------	----	S.E----	0.5	Cirrus, 1 -------
15	----do----------	9 a. m----	32.5	32.0	0.28	0.00	0.28	24.972	634.3	4.44	96	S.E----	1	Cir.-cumulus, 1--
15	----d0----------	12 m.-----	38.0	33.0	3.33	0.55	2.78	24.992	634.8	3.11	56	S.E----	2	Cir.-cumulus, 1--
15	----do----------	3 p. m---	36.9	33.0	2.72	0.55	2.17	25.011	635.3	3.47	65	S.E----	2	None ----------
15	----do----------	Sunset----	32.5	26.5	0.28	—3.06	3.34	24.998	634.9	1.85	43	S.E----	2	Cumulus, 0.5---
15	----do----------	9 p. m---	26.0	------	------	------	------	25.046	636.1	------	----	--------	0	None ----------
16	----do----------	9 a. m----	33.5	32.0	0.83	0.00	0.83	25.116	635.4	4.11	85	S.E----	0.5	Cir.-strat., 3----
19	Camp 101--------	3 p. m---	33.0	31.0	0.55	—0.55	1.10	24.660	626.3	3.94	81	S------	4	Nimbus, 5------
19	----do----------	Sunset----	29.0	------	------	------	------	24.702	627.4	------	----	S------	2	Nimbus, 3------
19	----do----------	8 p. m---	24.0	------	------	------	------	24.706	627.5	------	----	S------	0.5	None ----------
20	----do----------	9 a. m----	22.0	------	------	------	------	24.996	634.9	------	----	--------	0	None ----------
21	Camp 102--------	9 a. m----	28.5	------	------	------	------	24.644	625.9	------	----	--------	0	None ----------
21	Camp 103--------	3 p. m---	43.7	40.5	6.50	4.72	1.78	24.998	634.9	6.16	76	--------	0	Cirrus, 3-------
21	----do----------	Sunset----	34.0	32.0	1.11	0.00	1.11	25.010	635.3	3.94	81	--------	0	Stratus, 6 ------
21	----do----------	9 p. m---	23.0	------	------	------	------	24.994	634.8	------	----	--------	0	None ----------

(*) Inappreciable.

Halo around the moon 25° in diameter.

Unable to take the observations at sunset and 9 p. m. on account of a violent storm of wind; strength about 6, accompanied by showers of rain.

Early in the morning the moon and stars were shining in a perfectly clear sky. There was no wind till sunrise, when a cold breeze blew from the southeast, and cirro-cumulus clouds passed towards the east.

January 8.—The sun was obscured by thin clouds, but the temp. was mild, scarcely a breeze stirring. At 9 a. m. appearance of snow. Evening continued calm, but cloudy.

January 9.—At sunrise clouds, cirro-stratus, nearly covering the sky. The day was cloudy, but mild, and without wind. At night stars and the moon appeared for a short time.

January 10.—At sunrise clouds, thin cirrus, nearly covered the sky. At 10 a. m. clouds were ranged in stratus bands, spanning the sky in semi-circles, seeming to unite in the horizon at opposite points N.E. and S.W. from the magnetic meridian. This same phenomenon we have before frequently noticed, the radiating points having nearly the same direction. The wind rose from the N.E., seeming to have some affinity to the same cause. Electricity in this climate is very great, often sparkling and crackling as a hand is passed over blankets at night. At sunset the wind died away, leaving the sky clear. Both Venus and the moon were surrounded by a fringe of colored light, indicating the presence of congealed moisture in the atmosphere.

January 12.—At 10 o'clock last night the clouds disappeared, and the atmosphere became clear, calm, and cold. The sun rose bright, but clouds quickly formed in stratus bands radiating from the horizon N. 45° E. true course. Below them was a thin gauze-like veil of cirrus, which passed eastward; and at 9 a. m. nimbus clouds rose from the N.W., quickly spreading over the sky. The morning clouds were dissipated before midday by a light breeze from the S.W.

January 13.—Mottled cirrus clouds covering the sky tinted the east at sunrise with changing shades of scarlet and gold. At 9 a. m. a breeze from the south arose and scattered the bright clouds. The day was warm; the clouds that towards evening threatened rain were dispersed as usual by the full moon as she ascended towards the zenith.

January 19.—Commenced snowing last night at 7½ p. m., and continued during the night, accompanied by light gusts of wind. Ceased snowing at 8½ a. m.; commenced raining at 8¾ a. m.; rain changed to snow and sleet at 9½ a. m., and continued until 1 30 p. m.

January 21.—The day was pleasant; the sun causing snow to disappear from southern slopes. Not a cloud was visible until 3 p. m. A mottled cloud then covered the sky, but soon moved to the eastern horizon, leaving a starlight night clear and calm.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches.	In millimeters			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.									
1853.			°	°	°	°	°								
Jan. 22	Camp 103	Sunrise	26.0					25.070	636.8				0	Cum.-strat., 8	Very much like snow.
22	do	9 a. m	33.5	28.5	0.83	—1.94	2.77	25.102	637.6	2.47	55		0	Cum.-strat., 9	Appearances of rain.
22	Station 14	3 p. m	43.9	39.0	6.61	3.89	2.72	24.556	623.7	4.42	62		0	Cum.-strat., 9	
22	Camp 104	9 p. m	26.0										0	None	
23	do	Sunrise	26.8					24.508	622.5				0	Cirrus, 8	
23	do	9 a. m	42.5	38.0	5.83	3.33	2.50	24.536	623.2	4.32	63		0	Cirrus, 6	
23	Station 6	12 m	57.0	43.6	13.89	6.44	7 45	23.957	608.5	2.85	24		0	Cirrus, 8	
23	Camp 105	3 p. m	54.8	46.0	12.67	7.78	4.89	24.426	620.4	4.95	46		0	Cir.-cum., 7	
23	do	Sunset	41.9	38.5	5.50	3.61	1.89	24.442	620.8	4.80	73		0	Cumulus, 7	
23	do	9 p. m	38.0	37.5	3.33	3.05	0.28	24.418	620.2	5.54			0	Cumulus, 7	
24	do	Sunrise	39.9	35.4	4.39	1.89	2.50	24.402	619.8	3.81	62		0	Cir.-cum., 7	
24	Station D	12 m	53.7	42.0	12.05	5.55	6.50	24.668	626.5	2.91	28	S. S. E.	2	Cir.-cum., 5	
24	Camp 106	3 p. m	55.1	42.5	12.83	5.83	7.00	24.767	6 .	2.75	24	E.	0.5	Cir.-cum., 7	
24	do	Sunset	43.1	38.0	6.17	3.33	2.84	24.761	6 .9	4.13	58	E.	0.5	Cir.-cum., 4	
24	do	9 p. m	40.9	33.5	4.94	0.83	4.11	24.740	628.4	2.40	38	E.	1	None	
25	do	Sunrise	35.0	30.1	1.67	—1.06	2.73	24.654	626.2	2.78	58	S. E.	1	Cirrus, 7	In the morning a fresh wind blew from the south, and cirro-stratus clouds gave a greyish aspect to the sky.
25	do	9 a. m	47.0	39.2	8.33	4.00	4.33	24.668	626.5	3.51	44	S. E.	2	Cirrus, 9	
25	do	12 m	48.9	39.9	9.39	4.39	5.00	24.618	625.3	3.27	37	S. E.	2	Cirrus, 9	
25	do	3 p. m	44.1	38.0	6.72	3.33	3.39	24.554	623.6	3.80	53	S. E.	3	Cirro-eum., 9	
25	do	Sunset	40.6	36.0	4.78	2.22	2.56	24.534	623.1	3.86	62	S. S. E.	3	Nimbus, 10.	Commeneed raining at 5 p. m.
25	do	9 p. m	34.0	33.5	1.11	0.83	0.28	24.540	623.3	4.68	96		0	Nimbus, 10.	Commeneed snowing at 8 p. m.
26	do	9 a. m	49.0	39.0	9.44	3.89	5.55	24.756	628.8	2.73	32		0	None	Ceased snowing during the night; quantity of snow fallen not measured.
26	do	12 m	48.0	38.1	8.89	3.39	5.50	24.800	629.9	2.56	31	N	2	None	
26	do	3 p. m	42.5	35.5	5.83	1.94	3.89	24.800	629.9	3.01	44	N	2	None	
26	do	Sunset	31.5									N	1	None	
27	do	Sunrise	21.0					24.976	634.4			S. E.	0.5	None	Wind E.N.E.; sky cloudless. Since the cessation of the storm of the 25th, the wind has varied from north to east, and not a cloud has been visible. The air is dry.
27	do	9 a. m	40.0	35.0	4.44	1.67	2.77	25.030	635.7	3.56	58	S. E.	0.5	None	
27	Station 7	12 m	48.0	37.1	8.89	2.83	6.06	25.082	637.1	2.03	24	S. E.	0.5	Cirrus, 1	
27	Station 15	3 p. m	50.9	43.2	10.50	6.22	4.28	25.292	642.4	4.54	48	S. E.	0.5	Cirrus, 3	
27	Camp 107	Sunset	45.0	39.0	7.22	3.89	3.33	25.364	644.2	4.06	55		0	Cirrus, 3	
27	do	9 p. m	30.5					25.370	644.4				0	None	
28	do	Sunrise	37.0	32.0	2.78	0.00	2.78	25.336	643.5	2.96	55		0	Cirrus, 5	

28	----do----------	9 a. m---	50.5	40.0	10.28	4.44	5.84	25.360	644.1	2.79	30	--------	0	Cirrus, 6-------	
28	Camp 108--------	3 p. m---	65.0	44.5	18.33	6.94	11.39	25.344	643.7	0.64	4	N-------	0.5	Cirrus, 5-------	
28	----do----------	Sunset---	51.5	43.2	10.83	6.22	4.61	25.278	642.0	4.34	44	--------	0	Cirrus, 3-------	
28	----do----------	9 p. m---	40.0	36.5	4.44	2.50	1.94	25.312	642.9	4.35	70	--------	0	None----------	
29	----do----------	Sunrise---	28.5	28.0	—1.94	—2.22	—0.28	25.320	643.1	3.81	100	--------	0	Cirrus, 6-------	
29	----do----------	9 a. m---	54.0	44.2	12.22	6.78	5.44	25.352	643.9	4.13	39	--------	0	Cirrus, 7-------	
29	----do----------	12 m.-----	60.5	48.3	15.83	9.05	6.78	25.326	643.3	4.49	33	N. E---	0.8	Cumulus, 1------	Atmosphere smoky.
29	----do----------	3 p. m---	67.0	49.0	19.44	9.44	10.00	25.324	643.2	2.80	17	N. E---	1	Cirrus, 4-------	
29	----do----------	Sunset---	51.0	45.0	10.55	7.22	3.33	25.318	643.1	5.60	60	--------	0	Cirrus, 2-------	
29	----do----------	9 p. m---	41.0	37.0	5.00	2.78	2.22	25.320	643.1	4.29	66	--------	0	None----------	
30	----do----------	Sunrise---	30.1	30.1	—1.06	—1.06	0.00	25.367	644.3	4.27	100	--------	0	None----------	
30	----do----------	9 a. m---	49.0	40.2	9.44	4.55	4.89	25.414	645.5	3.38	39	--------	0	Cirrus, 2-------	
30	Station B--------	12 m.-----	59.0	38.6	15.00	3.66	11.34	25.320	643.1	(*)	(*)	N. E---	1	Cirrus, 3-------	(*) Inappreciable.
30	Station F--------	3 p. m---	68.0	53.7	20.00	12.05	7.95	25.388	644.8	5.67	33	--------	0	Cirrus, 6-------	
30	Camp 109--------	Sunset---	49.6	39.9	9.78	4.39	5.39	25.360	644.1	3.02	33	--------	0	Cirrus, 7-------	
30	----do----------	9 p. m---	42.5	38.1	5.83	3.39	2.44	25.328	643.3	4.39	63	--------	0	None----------	
31	----do----------	Sunrise---	30.0	29.2	—1.11	—1.56	—0.45	25.298	642.5	3.86	92	--------	0	None----------	
31	----do----------	9 a. m---	50.0	42.5	10.00	5.83	4.17	25.273	641.9	4.45	50	--------	0	None----------	
31	Camp 110--------	4 p. m---	73.9	60.0	23.28	15.55	7.73	24.976	634.4	8.43	40	--------	0	None----------	
31	----do----------	Sunset---	57.2	44.1	14.00	6.72	7.28	24.950	633.7	3.09	24	--------	0	None----------	
Feb. 1	----do----------	Sunrise---	41.0	37.0	5.00	2.78	2.22	24.800	629.9	4.29	66	--------	0	None----------	
1	----do----------	9 a. m---	63.5	48.9	17.50	9.39	8.11	24.854	631.3	3.91	26	--------	0	None----------	
1	Station 6--------	3 p. m---	69.5	49.2	20.83	9.56	11.27	25.984	660.0	2.12	11	--------	0	Cir.-strat., 1----	
1	Camp 111--------	Sunset---	62.0	47.0	16.67	8.33	8.34	26.332	668.8	3.19	23	--------	0	None----------	
2	----do----------	Sunrise---	36.0	33.0	2.22	0.55	1.67	26.432	671.3	3.77	71	--------	0	Cirrus, 4-------	
2	----do----------	9 a. m---	51.0	47.2	10.55	8.44	2.11	26.478	672.5	7.00	74	E.------	0.5	Cirrus, 3-------	
2	----do----------	12 m.-----	70.2	50.9	21.22	10.50	10.72	26.532	673.9	2.99	16	E.------	2	Cirrus, 0.5 -----	
2	----do----------	3 p. m---	67.5	49.9	19.72	9.94	9.78	26.458	672.0	3.24	20	E.------	0.5	Cirro-stratus, 8--	
2	----do----------	Sunset---	54.0	48.2	12.22	9.00	3.22	26.460	672.1	6.63	63	N------	0.5	Stratus, 8------	
3	----do----------	Sunrise---	38.5	35.8	3.61	2.11	1.50	26.466	672.2	4.45	76	--------	0	Cir.-eum.-stra., 7	
3	----do----------	9 a. m---	61.0	58.0	16.11	14.44	1.67	26.528	673.8	11.25	83	--------	0	Cir.-cum.-stra., 9	
3	----do----------	12 m.-----	68.0	47.1	20.00	8.39	11.61	26.516	673.5	1.25	7	S. W---	0.8	Cir.-eum. stra , 9	
3	----do----------	3 p. m---	68.8	51.9	20.44	11.05	9.39	26.474	672.4	4.15	24	S. W---	1	Cir.-eum.-stra., 9	

January 28.—At sunrise light eirro-stratus elouds hung upon the horizon, tinged with purple, and mingling with the pale blue sky above. Soon afterward a soft, balmly breeze sprung from the east, and eirrus clouds appeared near the zenith. The day was warm and spring-like. Atmosphere smoky. Brilliant meteor at 8.50 p. m. starting from the southern point of Orion, going west about 5° and disappearing. Tail about 2° in length.

January 30.—The breaking of day was attended with a phenomenon whieh has been notieed before. About 20 minutes before the sun's rays appeared upon the mountain peaks, a sudden flood of light was refleeted from the sky as if from a mirror; afterward the brightness of the atmosphere seareely ehanged until sunrise. There were a few light streaks of elouds at the horizon, and a stiff breeze from the east. During the night the wind blew strong and in gusts.

January 31.—At 6*h*. 6*m*. a. m. the grey of day-break was suddenly illuminated by a bright glow, tinging hill and valley with a golden hue. There was not a eloud in the sky. The breeze eontinued blowing from the east. The day was eloudless and ealm. At 9 p. m. the stars shone brightly, and the air was perfeetly still. 126 observations give 40° Fah. for the mean temperature of January. The highest temperature observed was 73°.9, the lowest 21° Fahrenheit.

February 2.—Throughout the day a gentle breeze blew from the east, and there were eirrus elouds upon a light blue sky. At sunset the wind passed around to the north, and the clouds were formed into stratus bands.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t-t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1853.			°	°	°	°	°								
Feb. 3	Camp 111	Sunset	62.1	54.5	16.72	12.50	4.22	26.457	672.0	8.25	58		0	Cir.-cum.-stra., 8	
3	do	9 p. m	46.0	39.2	7.78	4.00	3.78	26.440	671.6	3.83	51	W.	0.5	Cir-cumulus, 3	
4	do	Sunrise	41.1	38.6	5.06	3.66	1.40	26.445	671.7	5.11	77		0	Cirrus, 8	
4	Station 1	9 a. m	56.0	48.2	13.33	9.00	4.33	26.644	676.7	5.96	53		0	Cirrus, 8	
4	Camp 112	3 p. m	75.0	69.0	23.89	20.55	3.34	27.182	690.4	15.95	73	S.W	0.5	Cir.-cum , 9	
4	do	Sunset	63.5	50.0	17.50	10.00	7.50	27.150	689.6	4.64	32		0	Stratus, 2	At 6 p. m. wind changed to the north and dispersed the clouds.
4	do	8.30 p. m	40.5	35.0	4.72	1.67	3.05	27.142	689.4	3.40	53	N	0.5	None	
5	do	Sunrise	37.8	35.0	3.22	1.67	1.55	27.118	688.8	4.29	75	N	0.2	Cir.-cum., 10	
5	Station A	9 a. m	52.5	44.2	11.39	6.78	4.61	27.270	692.6	4.62	44		0	Cir -cum., 9	
5	Station 5	12 m	62.4	56.0	16.89	13.33	3.56	27.688	703.3	9.23	66	S	0.5	Cir.-cum., 9	
5	Station 11	3 p. m	69.2	49.7	20.67	9.83	10.84	27.836	707.0	2.54	13	S.E.	0.8	Cir.-cum., 9	
5	Camp 113	Sunset	64.0	53.1	17.78	11.72	6.06	27.844	707.2	6.62	44		0	Cir.-cum. stra. 7	
5	do	9 p. m	52.2	48.6	11.22	9.22	2.00	27.818	706.6	7.50	75		0	None	
6	do	Sunrise	40.0	38.6	4.44	3.66	0.78	27.828	706.8	5.48	90		0	Cir.-cum., 1	The morning was clear, with a gentle air from the east. Afterwards clouds and wind disappeared, and the temperature was spring-like. In the evening sky was pure, serene, and moon and stars shone brightly.
6	do	9 a. m	61.0	55.6	16.11	13.11	3.00	27.908	708.8	9.42	69		0	Cir.-cum., 3	
6	Station A	12 m	70.2	55.3	21.22	12.94	8.28	27.950	709.9	6.10	33		0	Cumulus, 2	
6	Station B	3 p. m	80.0	59.6	26.67	15.33	11.34	28.040	712.2	6.06	23	W.	1	Cumulus, 2	
6	Camp 114	Sunset	63.0	53.9	17.22	12.16	5.06	28.124	714.3	7.50	52		0	Cumulus, 1	
6	do	9 p. m	42.0	39.7	5.55	4.28	1.27	28.080	713.2	5.45	81		0	None	
7	do	Sunrise	32.0	------	------	------	------	28.072	713.0	------	----		0	None	The day was uncomfortably warm and calm except when occasional whirlwinds swept along, bearing aloft huge columns of dust. The evening was bright and nearly calm.
7	Station A	9 a. m	63.0	52.2	17.22	11.22	6.00	28.232	717.1	6.31	43		0	None	
7	Camp 115	12 m	74.5	54.0	23.61	12.22	11.39	28.294	718.6	3.70	17	N.N.W.	3	Cumulus, 3	
7	do	3 p. m	69.0	48.6	20.55	9.22	11.33	28.234	717.1	1.87	10	N.N.W.	2	Cumulus, 1	
7	do	Sunset	63.0	52.4	17.22	11.33	5.89	28.220	716.8	6.46	44	N.N.W.	2	Cirrus stratus, 1	
7	do	9 p. m	56.4	44.0	13.56	6.67	6.89	28.226	716.9	3.20	28	N.N.W.	0.2	None	
8	do	Sunrise	42.9	35.7	6.05	2.06	3.99	28.284	718.4	2.94	42	N.N.E	0.5	None	
8	Station 1	9 a. m	60.2	47.5	15.66	8.61	7.05	28.352	720.1	4.14	30	N.N.E	2	None	
8	Station 8	12 m	73.0	53.5	22.78	11.94	10.84	28.401	721.4	3.90	19		0	None	
8	Camp 116	3 p. m	75.0	51.8	23.89	11.00	12.89	28.418	721.8	1.94	10	S.E.	0.5	Cirrus, 0.2	
8	do	Sunset	66.0	50.9	18.89	10.50	8.39	28.361	720.4	4.39	27	S.E.	0.3	Cirrus, 0.5	
8	do	9 p. m	55.5	44.5	13.05	6.94	6.11	28.390	721.1	3.80	35	S.E.	1	None	Sky nearly covered with a thick haze.

9	----do----------	Sunrise.--	42.5	36.0	5.83	2.22	3.61	28.422	721.9	3.24	46	N -----	2	Cirrus, 2--------	Light cirro-stratus clouds, a warm
9	Station A.-------	9 a. m ---	63.0	53.2	17.22	11.78	5.44	28.490	723.6	7.06	47	W.N.W.	0.5	Cirrus, 1--------	sun and gentle breezes charac-
9	Camp 117.-------	12 m.-----	79.8	56.5	26.55	13.61	12.94	28.526	724.5	3.71	14	--------	0	Cirrus, 6--------	terized the day. The evening
9	----do----------	3 p. m----	77.0	60.0	25.00	15.55	9.45	28.474	723.2	7.38	31	--------	0	Cir.-cu.-cir.-st., 8	sky was variable, clouds passing
9	----do----------	Sunset ---	63.5	52.8	17.50	11.55	5.95	28.441	722.4	6.57	44	--------	0	Nim.-cir.-str., 6-	to the eastward. Appearances
9	----do----------	9 p. m----	44.9	39.0	7.16	3.89	3.27	28.438	722.3	4.10	53	--------	0	Nim.-cir.-str., 8,	of rain.
10	----do----------	Sunrise.--	42.9	38.0	6.05	3.33	2.72	28.446	722.5	4.19	61	--------	0	Stratus, 9-------	
10	----do----------	9 a. m----	55.0	45.0	12.78	7.22	5.56	28.500	723.9	4.26	40	S.E-----	0.5	Cirro-stratus, 9--	
10	Station A.-------	12 m.-----	70.6	55.0	21.44	12.78	8.66	28.545	725.0	5.76	31	--------	0	Cirro-stratus, 9--	
10	Camp 118.-------	3 p. m----	72.0	50.3	22.22	10.17	12.05	28.546	725.1	2.07	10	W------	0.8	Cir.-cum.-str., 10	
10	----do----------	Sunset ---	65.0	53.0	18.33	11.67	6.66	28.540	724.9	5.88	39	--------	0	Nimbus, 10------	
10	----do----------	9 p. m----	64.9	58.6	18.28	14.78	3.50	28.558	725.4	10.33	67	S.E-----	2	Nimbus, 10------	
11	----do----------	Sunrise.--	57.5	52.0	14.16	11.11	3.05	28.540	724.9	8.03	67	S.E-----	0.5	Nimbus, 10------	
11	----do----------	9 a. m----	56.8	51.0	13.78	10.55	3.23	28.581	725.9	8.11	64	S.E-----	0.5	Nimbus, 10------	
11	Station A.-------	12 m.-----	60.0	57.9	15.55	14.39	1.16	28.642	727.5	11.51	89	E.------	0.2	Nimbus, 10------	
11	Camp 119.-------	3 p. m----	57.2	56.2	14.00	13.44	0.56	28.650	727.7	11.13	95	S.E-----	0.5	Nimbus, 10------	
11	----do----------	Sunset ---	57.0	56.4	13.89	13.56	0.33	28.615	726.8	11.35	98	--------	0	Nim.-cum., 10--	
11	----do----------	9 p. m----	56.8	53.0	13.78	11.67	2.11	28.574	725.8	8.98	77	--------	0	Nim.-cum., 10--	
12	----do----------	Sunrise.--	49.8	48.5	9.89	9.16	0.73	28.604	726.5	8.23	92	--------	0	Cir.-cu.&ci.-st., 4	Considerable rain fell last night,
12	----do----------	9 a. m----	69.0	59.0	20.55	15.00	5.55	28.678	728.4	9.32	53	--------	0	Cumulus, 4------	but the morning was bright and
12	Station A.-------	12 m.-----	69.0	54.8	20.55	12.67	7.88	28.728	729.7	6.15	33	S.E-----	3	Cumulus, 7------	clear. The day continued plea-
12	Camp 120.-------	3 p. m----	72.5	55.8	22.50	13.22	9.28	28.750	730.2	5.68	28	S.E-----	3	Cumulus, 5------	sant.
12	----do----------	Sunset ---	64.7	54.6	18.16	12.55	5.61	28.736	729.9	7.43	47	S.E-----	2	Cirrus, 1--------	
12	----do----------	9 p. m----	56.5	45.0	13.61	7.22	6.39	28.746	730.1	3.76	32	S.E-----	0.5	None------------	
13	----do----------	Sunrise.--	34.0	33.5	1.11	0.83	0.28	29.750	730.2	4.68	96	--------	0	Cirrus, 5--------	Slight frost last night; very hazy.
13	----do----------	9 a. m----	51.0	45.5	10.55	7.50	3.05	28.818	732.0	5.91	62	--------	0	Cirrus, 7--------	
13	Station A.-------	12 m.-----	59.5	47.5	15.28	8.61	6.67	28.966	735.7	4.37	33	S.W ----	0.5	Cir.-cumulus, 6--	
13	Camp 121.-------	3 p. m----	62.0	49.0	16.67	9.44	7.23	28.982	736.1	4.47	32	--------	0	Cir -cumulus, 7--	
13	----do----------	Sunset ---	59.5	48.2	15.28	9.00	6.28	28.973	735.9	4.79	38	S.W ----	0.5	Cir.-cumulus, 8--	
14	----do----------	Sunrise.--	40.0	34.9	4.44	1.61	2.83	29.074	738.5	3.47	55	--------	0	None -----------	Strong wind from N.W. during day.
14	----do----------	9 a. m----	54.9	43.5	12.72	6.39	6.33	29.116	739.5	3.24	31	N.N.W.	0.5	None -----------	
14	----do----------	12 m.-----	64.5	55.3	18.05	12.94	5.11	29.072	738.4	7.42	53	N.N.W.	3	None -----------	
14	----do----------	3 p. m----	63.0	47.0	17.22	8.33	8.89	29.026	737.2	2.68	19	N.N.W.	2	Cumulus, 0.5 ----	

February 3.—Notwithstanding many incomplete and fleeting halos and coronæ that played among cirro-stratus clouds around the moon last night, the breeze returned to the east, and morning opened with indications of fair weather. A light frost was formed last night. Clouds, cirro-cumulo-stratus, were abundant during the day, and at sunset were tinged, east and west alike, with red. At 9 p. m. a breeze blew from the west, and the moon was occasionally clouded.

February 4.—The night was raw, with gusts of wind from the northeast. In the morning masses of clouds moved slowly from the west, occasionally obscuring the sun, and forming imperfect coronæ. Dark clouds that during the day threatened rain, disappeared at sunset, leaving only a few strata at the western horizon. The breeze, also, which since 9 a. m. swept from the south, became quiet.

February 5.—Covering the eastern sky in the morning was a black cloud slightly raised, disclosing a beautiful sunrise, with red and purple tints. A light air came from the north. Before 9 a. m. the sun broke through the clouds which remained only in cumulus masses, moving eastward through patches of deep blue sky. At night there was no indication of clouds, except a faint halo around the moon.

February 10.—The sunrise was very beautiful. Stratus clouds nearly covered the sky, but the whole atmosphere partook of a crimson tint. An hour afterwards the clouds broke into flocculent fragments and cirro-stratus bands. The wind was in puffs from the S.E. In the afterpart of the day the clouds thickened, and toward evening produced a shower.

February 11.—Several showers occurred last night. At sunrise a steady rain set in. Before noon the wind veered toward the east and the sun broke out for a moment; but the sky was again covered with clouds till sunset, when they slightly lifted from the west, showing a patch of pea-green sky bordered with red. The moon soon after shone out, but quickly disappeared, and a drizzling rain commenced falling.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psyehrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches.	In millimet's			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb. t'.									
1853.			°	°	°	°	°								
14	Camp 121	Sunset	56.0	43.0	13.33	6.11	7.22	29.032	737.4	2.83	24	N.N.W.	3	None	Atmosphere smoky.
14	do	9 p. m	50.0	37.7	10.00	3.17	6.83	29.026	737.2	1.70	18	N.N.W.	3	None	
15	do	Sunrise	45.3	35.5	7.39	1.94	5.45	29.108	739.3	1.74	24	N.W	3	None	A strong wind prevailed last night from the N.W. The morning was clear, but the wind continued until 9 a. m., when it became calm.
15	do	9 a. m	53.0	43.6	11.67	6.44	5.23	29.188	741.4	3.89	39	N NW	0.2	None	
15	Sta. 7, Rd. survey	3 p. m	61.0	43.5	16.11	6.39	9.72	29.262	743.2	1.20	9	W.N	1	None	
15	Camp 122	Sunset	59.5	45.0	15.28	7.22	8.06	29.266	743.3	2.66	21		0	None	
15	do	9 p. m	41.7	37.8	5.39	3.22	2.17	29.167	740.8	5.44	70		0	None	
16	do	Sunrise	41.4	34.0	5.22	1.11	4.11	29.046	737.8	2.54	39	E.N.E.	3	Cirrus-stratus, 7	Night calm. Towards morning arose a high wind, which at 9 a. m. passed away.
16	do	9 a. m	53.9	43.2	12.16	6.22	5.94	29.077	738.5	3.55	34	N.N.E.	0.2	Cirro-eum., 6	
16	Camp 123	3 p. m	70.0	53.0	21.11	11.67	9.44	29.102	739.2	4.56	24	S	0.5	Cirrus, 3	
17	do	Sunrise	48.7	43.0	9.28	6.11	3.17	29.128	739.8	5.15	61	N.N.E.	3	Stratus, 9	
18	Camp 124	Sunrise	46.5	46.2	8.05	7.89	0.16	29.286	743.8	7.83	100	S	0.5	Cumulus, 9	
18	Camp 125	12 m	55.1	52.0	12.83	11.11	1.72	29.520	749.8	8.83	100	S	1	Cumulus, 8	
18	do	3 p. m	53.7	51.8	12.05	11.00	1.05	29.560	750.8	9.19	100	S.W	0.5	Cumulus, 8	
18	do	Sunset	53.3	49.4	11.84	9.66	2.18	29.574	751.2	7.66	75	N.W.	0.5	None	
18	do	9 p. m	44.3	43.9	6.83	6.61	0.22	29.638	752.8	7.18	97		0	None	
19	do	Sunrise	31.0										0	None	
19	Camp 126	Sunset	60.9	53.5	16.06	11.94	4.12	29.700	754.4	7.96	59	S.W	2	Cumulus, 8	
21	Camp 127	7 a. m.	49.5	46.5	9.72	8.05	1.67	29.804	757.0	7.05	79	S	0.5	None	
21	Camp 128	9 p. m	58.6	50.5	14.78	10.28	4.50	29.786	756.5	6.59	53	N.W	0.5	Cumulus, 3	Rain.
22	Camp 129	Sunset	61.7	50.2	16.50	10.11	6.39	29.800	756.9	5.37	38	N.W.	0.3	Cirrus-eum., 9	The evening cloudy. Not a star visible.
25	Camp 132	Sunset	68.0	49.3	20.00	9.61	10.39	29.701	754.4	2.67	14	S.W	3	Cirrus, 1	
25	do	9 p. m	55.5	43.5	13.05	6.39	6.66	29.636	752.7	3.20	28	E	1	None	
26	do	Sunrise	37.5					29.582	751.4				0	Cirrus, 1	The day warm and pleasant, and the evening clear.
26	do	9 a. m	62.3	55.0	16.83	12.78	4.05	29.664	753.4	8.55	60		0	Cirrus, 8	
26	Camp 133	3 p. m	71.2	54.0	21.78	12.22	9.56	29.676	753.8	4.81	25		0	None	
27	do	9 a. m	64.0					29.860					0	None	107 observations give 57°.4 Fahr. for the mean temp. of February.
28	Camp 134	8.45 a. m.	60.5					29.632					0	None	The highest temperature obs'd

	28	----do----------	Sunset----	61.9					29.524				0	None ----------	during the month was 80°; the
	28	----do----------	9 p. m----	50.0					29.588				0	Cumulus, 3-----	lowest 31°.
Mar.	1	----do----------	Sunrise.---	37.2					29.652				0	Cir.-cum., 2-----	The wind blew all day in strong
	1	----do----------	9 a. m----	59.7					29.774				0	None ----------	gusts from the N.W., with occa-
	1	Camp 135--------	12 m.-----	59.5					29.724			N.W----	1	Cum., 4--------	sionally a slight sprinkling of
	1	----do----------	3 p. m----	61.2					29.746				0	Cir.-cum., 3-----	rain. At night the sky became
	1	----do----------	Sunset----	53.6					29.748			N.W----	2	Cum., 3--------	clear.
	1	----do----------	9 p. m----	41.7					29.762				0	None ----------	
	2	----do----------	Sunrise.---	40.7					29.864			N.W----	0.6	Cir., 1----------	
	2	Station B---------	9 a. m----	51.0					29.646			N-------	0.3	Cir.-cum., 8-----	
	2	Station 4---------	12 m.-----	65.7					29.026				0	None ----------	
	2	Station D.--------	3 p. m ----	60.5					28.508			W-------	0.5	None ----------	
	2	Camp 136--------	6.10 p. m.	49.5					27.900			W-------	0.3	None ----------	
	2	----do----------	9 p. m----	44.5					27.890			N.W----	2	None ----------	
	3	----do----------	Sunrise.---	43.0					27.856			N W----	0.7	None ----------	Sky very smoky.
	3	Station 2---------	9 a. m----	44.7					27.900			N.E.----	0.8	None ----------	
	3	Camp 137--------	12 m.-----	69.3					27.372				0	None ----------	
	3	----do----------	3 p. m----	60.2					27.280			N.W----	0.5	Cir.-cum., 4-----	
	3	----do----------	Sunset----	54.7					27.264				0	Cir.-cum., 4-----	
	3	----do----------	9 p. m----	44.6					27.216				0	None ----------	
	4	----do----------	Sunrise.---	40.7					27.150			S. W----	0.8	Stratus, 7-------	Stratus clouds were red and low-
	4	Station B---------	9.40 a. m.	53.5					26.548				0	None ----------	ering at sunrise, and a breeze
	4	Station F---------	12 m.-----	59.0					26.342			N.N.E..	2	Cir., 7----------	came from the west damp and
	4	Station P---------	3 p. m----	55.0					25.809			N.N.E..	1	Cir.-cum., 8-----	disagreeable.
	4	Camp 138--------	Sunset----	55.6					25.682			N-------	1	Cir.-cum., 9-----	
	4	----do----------	9 p. m----	47.8					25.684			S-------	0.7	Cir., 9----------	
	5	----do----------	Sunrise.---	38.2					25.596			W-------	2	Cir.-cum., 7-----	The day cloudy and cool, with
	5	Station D---------	9 a. m----	46.2					25.286			W-------	0.5	Cir.-cum., 6-----	wind from the west. The night
	5	Camp 139--------	12 m.-----	52.8					25.180			S. W----	0.5	Cir.-cum., 9-----	lowering, with here and there
	5	----do----------	3 p. m----	52.0					25.146			E.------	0.3	Cir.-cum., 9-----	a star dimly seen behind the
	5	----do----------	9 p. m----	37.0					25.106			W-------	0.3	Cir.-cum., 8-----	clouds. A stiff westerly breeze blowing.
	6	----do----------	Sunrise.---	31.0					25.064			S.W.----	2	Cir.-cum., 10----	
	6	----do----------	9 p. m----	35.5					26.031			S.W.----	0.5	None ----------	

February 17.—Stratus clouds covered the heavens at sunrise. At 8 a. m. there were patches of blue sky, and the sun appeared. At 9 a. m. arose a gale from N.E., bringing clouds—cumulus, stratus, and nimbus. At noon rain fell fast, and was scarcely interrupted during the remainder of the day and the night.

February 18.—There were light breezes from the south, and a momentary cessation of rain at sunrise. Soon afterward showers returned, and, interspersed with occasional periods of sunshine, were frequent during the day. At sunset the rain ceased. The atmosphere at first assumed a yellowish tinge, and then acquired that perfect transparency which may frequently be observed in the climate of New Mexico at the instant preceding sunrise, and sometimes at sunset. At those moments there is, as it were, an equilibrium of elements, clearing the atmosphere of all vapory impurities and producing a great calm. The evening clear.

February 19.—Very heavy frost during the night. Morning calm and cloudless. At sunrise a white frost covered the ground, and a dense fog filled the valley. The day fine, with a light breeze and a few cirro-cumulus clouds floating in the sky. Towards evening the wind increased, and brought from S.W. a mass of denser clouds, which, however, passed over without rain. At 9 p. m., although calm, clouds again appeared.

March 6.—At 4 p. m. the wind shifted to the south, the clouds broke away, and there was a calm sunset. The evening gloomy and cold.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1853.			°	°	°	°	°								
Mar. 7	Camp 140	Sunrise	38.5					26.076				E.	0.8	Cir.-cum., 1	With the sun arose a breeze from the east, which, soon changing its course, increased to a gale from the north, excessively cold and disagreeable. At sunset clouds and wind disappeared, and the evening is clear and calm.
7	Station D	9.10 a. m.	45.5					26.416				N.E.	2	Cir.-cum., 1	
7	Station 9	12 m.	54.5					26.204				N.E.	1	Cir.-cum., 8	
7	Station B	2.40 p. m.	56.0					26.822				N.E.	0.3	Cir.-cum., 4	
7	Camp 141	Sunset	57.5					27.832					0	Cum., 2	
7	----do	9 p. m	55.0					27.814					0	None	
8	----do	Sunrise	49.0					27.831				E.	0.5	None	
8	Station D	9 a. m	55.5					28.702					0	None	
8	Station A	12 m.	69.0					28.250				W.	0.5	None	
8	Camp 142	3 p. m	83.2					28.971				S. W	0.3	Cir., 3	
8	----do	Sunset	72.5					28.930					0	Cir., 3	
8	----do	9 p. m	46.0					28.888					0	None	
9	----do	Sunrise	47.0					29.086					0	None	
9	Station D	9 a. m	69.7					29.133					0	None	
9	Camp 143	1.30 p. m.	85.5					28.894					0	None	
9	----do	3 p. m	82.2					28.874					0	None	
9	----do	Sunset	68.5					28.860					0	None	
9	----do	9 p. m	56.0					28.872				S. W	0.3	None	
10	----do	Sunrise	44.6					28.838				S. W	0.3	None	
10	Station D	9 a. m	58.7					28.732					0	None	
10	Station 6	12 m.	84.7					28.580				S. W	0.3	Cir.-cum., 6	
10	Station D	3 p. m	78.5					28.500					0	Cir.-cum., 6	
10	Camp 144	Sunset	69.5					28.420				S	0.3	Cir., 5	
11	----do	Sunrise	47.6					28.333					0	Cum., 8	Evening cool; strong wind from the west, driving before it dense masses of clouds.
11	----do	12 m.	68.0					28.066				S	1	Cir.-cum., 9	
11	----do	Sunset	55.0					27.994				W	2	Cir.-cum., 4	
11	----do	9 p. m	47.5					27.988				W	3	Cum., 1	
12	Camp 145	Sunrise	37.7					28.034				W	2	Cum., 7	Heavy gale last night; wind in gusts at sunrise; sky pure blue.
12	----do	9 a. m	47.5					28.098				W	3	Cum., 2	
12	----do	12 m	58.7					28.120				W.S.W.	1	None	
12	----do	3 p. m	64.3					28.118				W.N.W.	1	None	
12	----do	Sunset	52.2					28.124				W	1	None	
12	----do	9 p. m	30.7					28.450					0	None	

13	----do----------	Sunrise --	27.0	------	------	------	------	28.089	------	------	----	--------	0	None ----------	
13	Station 1-------	8.35 a. m.	52.3	------	------	------	------	28.092	------	------	----	--------	0	None ----------	
13	Station 4-------	12 m ----	74.3	------	------	------	------	27.910	------	------	----	N.E ---	0.3	None ----------	
13	Camp 146--------	Sunset ---	60.0	------	------	------	------	27.722	------	------	----	W------	1	None ----------	
14	----do----------	Sunrise --	29.8	------	------	------	------	27.776	------	------	----	--------	0	None ----------	At 4 p. m. a strong breeze arose from the west, which after sunset increased to a gale. At 9 p. m. it subsided; the clouds passed over and the moon appeared.
14	Station 5-------	8.45 a. m.	49.3	------	------	------	------	27.782	------	------	----	W------	0.6	Cir., 1 ---------	
14	Station 8-------	12 m ----	66.5	------	------	------	------	27.632	------	------	----	W------	0.3	None ----------	
14	----do----------	3 p. m----	63.0	------	------	------	------	27.598	------	------	----	W------	2	Cir., 1 ---------	
14	Camp 147--------	Sunset ---	51.5	------	------	------	------	27.434	------	------	----	--------	----	----------	
14	----do----------	9 p. m----	46.5	------	------	------	------	27.457	------	------	----	--------	0	Cir.-cum., 3----	
15	----do----------	Sunrise --	44.0	------	------	------	------	27.516	------	------	----	W------	0.3	Nim., 9---------	Few drops of rain.
15	Station 4-------	10 a. m---	49.5	------	------	------	------	27.426	------	------	----	--------	0	Cir.-cum., 7 ----	
15	Station 5-------	12 m ----	58.5	------	------	------	------	27.370	------	------	----	S------	1	Cir.-eum., 6 ----	
15	----do----------	2.45 p. m.	62.5	------	------	------	------	27.362	------	------	----	S------	0.8	Cir.-eum., 6 ----	
15	Camp 148--------	9.40 p. m.	38.8	------	------	------	------	27.113	------	------	----	W------	0.3	Cir. & cir.-stra., 5	
16	----do----------	Sunrise --	37.5	------	------	------	------	26.504	------	------	----	S------	0.3	Cir.-cum., 9 ----	The day clear, with a cold wind.
16	Station 4-------	9 a. m----	55.5	------	------	------	------	25.448	------	------	----	S.E----	0.5	Cir.-eum., 5 ----	Clouds gathered during the evening, and at 10 p. m. a light rain commeneed.
16	Station 6-------	12 m ----	57.0	------	------	------	------	27.026	------	------	----	W------	2	Cum., 1---------	
16	----do----------	3 p. m----	61.0	------	------	------	------	26.998	------	------	----	W------	1	Cum., 1---------	
16	Camp 149--------	Sunset ---	53.5	------	------	------	------	27.428	------	------	----	--------	0	None ----------	
16	----do----------	9 p. m----	43.7	------	------	------	------	27.426	------	------	----	W------	0.8	Cum., 9---------	
17	----do----------	Sunrise --	42.6	------	------	------	------	27.424	------	------	----	--------	0	Nim., 10 --------	Rained last night.
17	----do----------	9 a. m----	50.7	------	------	------	------	27.442	------	------	----	--------	0	Cir.-cum, 10 ----	Recommeneed raining at 10 a. m.; rained hard at 12 m., and stopped at 2.15 p. m. Began again at 3 p. m. and stopped at 4 p. m.
17	----do----------	12 m ----	44.7	------	------	------	------	27.410	------	------	----	--------	0	Nim., 10 --------	
17	----do----------	3 p. m----	43.5	------	------	------	------	27.340	------	------	----	S.W. --	1	Nim., 10 --------	
17	----do----------	Sunset ---	42.5	------	------	------	------	27.386	------	------	----	--------	0	None ----------	
18	----do----------	Sunrise --	42.0	------	------	------	------	27.354	------	------	----	E -----	1	Nimbus, 10 -----	Rain continued to descend in showers until evening, after which the easterly wind died away and the clouds broke in the west. At 9 p. m. few stars seen dimly through the clouds. No rain after sunset.
18	Station 1-------	9 a. m----	44.0	------	------	------	------	27.854	------	------	----	E -----	1	Nimbus, 10 -----	
18	Station 2-------	12 m ----	45.5	------	------	------	------	27.882	------	------	----	E -----	1	Nimbus, 10 -----	
18	Station F-------	3 p. m----	47.5	------	------	------	------	28.472	------	------	----	E -----	1	Nimbus, 10 -----	
18	Camp 150 --------	Sunset ---	47.0	------	------	------	------	28.670	------	------	----	--------	0	Nimbus, 10 -----	
19	----do----------	Sunrise --	45.0	------	------	------	------	28.764	------	------	----	--------	0	Cir.-cum, 9-----	
19	----do----------	9 a. m----	66.7	------	------	------	------	28.838	------	------	----	--------	0	Cum., 8---------	
19	----do----------	12 m ----	61.5	------	------	------	------	28.820	------	------	----	S------	0.6	Cum., 6---------	
19	----do----------	3.30 p. m.	52.2	------	------	------	------	28.798	------	------	----	W------	0.5	Cum., 9---------	Wind in gusts; slight fall of rain at 3 p. m.
19	----do----------	Sunset ---	50.5	------	------	------	------	28.804	------	------	----	N ------	0.3	Cum., 5---------	
19	----do----------	9 p. m----	47.0	------	------	------	------	28.818	------	------	----	N.N.W.	0.6	Cum., 3---------	
20	----do----------	Sunrise --	37.5	------	------	------	------	28.788	------	------	----	N.N.W.	0.8	None ----------	Heavy fog.
20	Station D-------	9 a. m----	54.5	------	------	------	------	29.026	------	------	----	S.S.W.-	0.5	Cum., 1---------	
20	Station 9-------	12 m ----	67.6	------	------	------	------	29.274	------	------	----	S------	0.5	Cum., 3---------	
20	Station P-------	3 p. m----	65.5	------	------	------	------	29.472	------	------	----	S. W---	0.5	Cum., 2---------	
20	Station H-------	Sunset ---	57.0	------	------	------	------	29.754	------	------	----	W------	0.3	Cir., 3 ---------	
20	Camp 151 --------	9 p. m----	47.5	------	------	------	------	29.824	------	------	----	--------	0	None ----------	
21	----do----------	Sunrise --	36.7	------	------	------	------	29.764	------	------	----	--------	0	None ----------	

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1854.			°	°	°	°	°								
Mar. 21	Station D.	9 a. m.	62.3					29.798					0	Cir., 3	
21	Camp 152.	12 m	68.2					29.710				S. W.	0.4	Cir.-cum., 3	
21	----do	3 p. m.	68.7					29.672				S. W.	0.5	Cir., 7	
21	----do	Sunset	55.0					29.670					0	Cir., 4	
21	----do	9 p. m.	49.5					29.708				E	0.2	Cir.-cum., 1	
22	----do	Sunrise	42.0					29.606				N	0.3	None	
22	----do	9 a. m.	65.0					29.826				N	0.3	Cum., 5	Foggy.
22	----do	12 m	67.0					29.744				S. W.	0.6	Cum., 4	Hazy.
22	----do	3 p. m.	64.5					29.703				S. W.	0.2	Cir.-cum., 1	Hazy.
22	----do	Sunset	55.2					29.700					0	Cir.-cum., 1	Hazy.
22	----do	9 p. m.	51.5					29.742				N.E	0.2	None	Foggy.
24	Port of San Pedro	8 a. m.	68.0					30.030					0	None	About 30 feet above mean tide.
May 1	Bitumen Sp'gs, near Los Angeles	Sunset	55.5	52.6	13.05	11.44	1.61	29.494	749.1	9.11	81		0	Cir.-cum., 3	Wind rose at 10 a. m.; subsided between 5 p. m. and sunset.
2	----do	Sunrise	46.0	45.9	7.78	7.72	0.06	29.511	749.6	7.82	100		0	Cumulus, 3	Wind rose at 10½ a. m.; subsided between 3 and 6 p. m. Evening clear. Heavy dew last night.
2	----do	12 m.	73.4	60.0	23.00	15.55	7.45	29.501	749.3	8.60	41	S. W.	3	Cumulus, 1	
2	----do	Sunset	66.5	58.5	19.16	14.72	4.44	29.466	748.4	9.78	60		0	Cirrus, 0.5	
3	----do	Sunrise.	49.5	48.7	9.72	9.28	0.44	29.619	752.3	8.47	95		0	Cumulus, 1	Hazy in horizon at 12 m. Evening cloudy, with appearance of rain. Heavy dew last night.
3	----do	12 m.	71.3	62.7	21.83	17.05	4.78	29.652	753.1	11.54	61	S. S. W.	1	Cumulus, 2	
3	----do	Sunset	57.8	55.8	14.33	13.22	1.11	29.694	754.2	10.65	89		0	Cir.-cum., 4	
4	----do	Sunrise.	55.9	55.0	13.28	12.78	0.50	29.684	754.0	10.69	95		0	Cir.-nim., 9	Slight fall of rain during the night—quantity .019. Misty between 8 and 10 a. m. Evening cloudy.
4	----do	12 m.	64.1	59.9	17.83	15.50	2.33	29.709	754.6	11.68	78		0	Cum.-nim., 10	
4	----do	Sunset	60.4	57.0	15.83	13.89	1.94	29.650	753.1	10.70	81	S. W.	1	Cir.-cum., 9	
5	----do	Sunrise.	55.8	55.8	13.22	13.22	0.00	29.646	753.0	11.31	100		0	Nimbus, 10	At sunrise atmosphere saturated with moisture, and slight drizzling rain; ceased at 8 a. m.; too slight for meas't. Ev'g cloudy.
5	----do	12 m.	63.0	59.5	17.22	15.28	1.94	29.650	753.1	11.74	81	S. W.	1	Cum.-nim., 10	
5	----do	Sunset	57.8	55.6	14.33	13.11	1.22	29.593	751.6	10.51	86	S. W.	1	Cum.-nim., 10	
6	----do	Sunrise.	47.5	46.9	8.61	8.28	0.33	26.605	752.0	7.96	97		0	Cumulus, 2	Slightly hazy in horizon at 12 m. Wind sprung up between 8 and 9 a. m. Evening cloudy.
6	----do	12 m.	53.9	53.5	12.16	11.94	0.22	29.653	753.2	10.32	98	S. W.	3	Cumulus, 4	
6	----do	Sunset	54.0	50.0	12.22	10.00	2.22	29.665	753.5	7.83	74	S. W.	1	Cir.-cum.-cir., 2	

7	----do----------	Sunrise---	42.9	42.1	6.05	5.61	0.44	29.749	755.6	6.57	94	--------	0	Cirrus, 1 -------	
7	----do----------	12 m.-----	63.5	51.5	17.50	10.83	6.67	29.738	755.3	5.64	38	S. W----	4	Cumulus, 0.5---	
7	----do----------	Sunset----	54.9	51.5	12.72	10.83	1.89	29.709	754.6	8.53	79	--------	0	Cirrus, 5 -------	
8	----do----------	Sunrise---	41.0	39.2	5.00	4.00	1.00	29.693	754.2	5.50	84	--------	0	Cirrus, 1 -------	
8	----do----------	12 m.-----	68.9	55.5	20.50	13.05	7.45	29.663	753.4	6.67	37	S. W----	3	Cirrus, 3 -------	
8	----do----------	Sunset----	57.5	53.6	14.16	12.00	2.16	29.616	752.2	9.16	78	--------	0	Cirrus, 8 -------	
9	----do----------	Sunrise---	40.0	39.5	4.44	4.16	0.28	29.628	752.5	5.99	97	--------	0	None ----------	
9	----do----------	12 m.-----	71.6	59.0	22.00	15.00	7.00	29.628	752.5	8.44	43	S. W----	1	None ----------	
9	----do----------	Sunset----	59.0	55.0	15.00	12.78	2.22	29.658	753.3	9.65	76	--------	0	None ----------	
10	----do----------	Sunrise---	41.0	40.9	5.00	4.94	0.06	29.660	753.3	6.44	100	--------	0	None ----------	
10	----do----------	12 m.-----	66.0	58.5	18.89	14.72	4.17	29.670	753.6	9.95	63	S. W----	1	Cir.-cum., 2-----	
10	----do----------	Sunset----	57.2	53.5	14.00	11.94	2.06	29.596	751.7	9.21	78	--------	0	Cir.-cum., 3-----	
11	----do----------	Sunrise---	53.5	52.0	11.94	11.11	0.83	29.581	751.3	9.37	90	--------	0	Cir.-cum., 10---	
11	----do----------	12 m.-----	64.9	56.6	18.28	13.66	4.62	29.557	750.7	8.82	56	S. E.----	1	Cir.-cum.-nim, 7	
11	----do----------	Sunset----	55.2	51.9	12.89	11.05	1.84	29.489	749.0	8.71	79	--------	0	Cir.-cum., 6 ----	
12	----do----------	Sunrise---	44.5	44.0	6.94	6.67	0.27	29.590	751.6	7.31	100	--------	0	None ----------	
12	----do----------	12 m.-----	66.0	56.2	18.89	13.44	5.45	29.635	752.7	8.15	50	S. W----	0.2	Cum., 7---------	
12	----do----------	Sunset----	58.7	53.0	14.83	11.67	3.16	29.654	753.2	8.36	67	--------	0	Cir.-cum., 4-----	
13	----do----------	Sunrise---	47.9	46.9	8.83	8.28	0.55	29.630	752.6	7.83	94	--------	0	Cir.-cum.-cir.-st., 10.	Evening clear, excepting small bank of cum. clouds in N. E. No dew last night.
13	----do----------	12 m.-----	60.0	54.5	15.55	12.50	3.05	29.640	752.8	8.96	68	S.E.----	1	Cir.-cum., 10.---	
13	----do----------	Sunset----	54.9	52.8	12.72	11.55	1.17	29.558	750.8	9.47	87	S. W----	1	Cir.-cum., 5.----	
14	----do----------	Sunrise---	45.9	45.2	7.72	7.33	0.39	29.637	752.8	7.41	94	--------	0	Cir.-cum., 2-----	
14	----do----------	12 m.-----	63.0	54.1	17.22	12.27	4.95	29.664	753.4	7.65	53	S. W----	1	Cum., 4---------	
14	----do----------	Sunset----	55.6	52.0	13.11	11.11	2.00	29.656	753.2	8.66	77	--------	0	Cir.-cum., 7----	
15	----do----------	Sunrise---	41.6	40.4	5.33	4.66	0.67	29.762	755.9	5.96	90	--------	0	None ----------	
15	----do----------	12 m.-----	66.0	57.5	18.89	14.16	4.73	29.820	757.4	9.16	57	S. W----	3	None ----------	
15	----do----------	Sunset----	55.0	52.0	12.78	11.11	1.67	29.802	757.0	8.86	81	--------	0	None ----------	
16	----do----------	Sunrise---	43.6	43.0	6.44	6.11	0.33	29.779	756.4	6.85	97	--------	0	Nonc ----------	At 12 m. and at sunset, hazy in horizon; wind rose at 10½ a. m.; subsided between 3 p. m. and sunset. Heavy dew last night.
16	----do----------	12 m.-----	72.2	61.0	22.33	16.11	6.22	29.710	754.6	9.84	49	S. W----	2	None ----------	
16	----do----------	Sunset----	63.4	58.9	17.44	14.94	2.50	29.616	752.2	11.14	76	--------	0	Cir.-stratus, 1---	

May 7.—At 12 m., hazy in S. W. At sunset, very hazy in horizon, and foggy in S. W. Slight frost last night. Wind sprang up shortly after sunrise; subsided between 3 and 6 p. m. Evening clear.

May 8.—At sunset, hazy in horizon and foggy in S. W. Heavy frost last night. Wind sprang up at 11 a. m.; died away between 3 and 6 p. m. Evening clear.

May 9.—Hazy in horizon at 12 m. and sunset. Slight frost last night. Wind sprang up at 11 a. m., died away between 3 and 6 p. m. First part of evening clear. Thick fog from 7 to 8 p. m.

May 10.—At 12 m., hazy in horizon. At sunrise, foggy in S. W. Wind rose at 10½ a. m.; died away between 3 and 6 p. m. Thick fog came from W. 7 p. m. Heavy dew last night.

May 11.—Showery during early part of morning, not sufficient for measurement. Evening clear. Wind sprang up at 11 a. m.; died away between 6 p. m. and sunset. No dew last night.

May 12.—Hazy in the horizon during the day. Wind rose from southwest at 12 m.; died away between 6 p. m. and sunset; force (.2); evening nearly clear. Heavy dew last night.

May 14.—At sunrise, slightly hazy in horizon; at sunset, foggy in northeast. Wind rose at 11 a. m.; died away between 6 p. m. and sunset. Heavy dew last night.

May 15.—At 12 m. and sunset, hazy in horizon. Wind sprung up from southwest at 10½ a. m.; subsided between 3 p. m. and sunset; evening clear. Heavy dew last night.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches.	In millimet's			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.									
1854.			°	°	°	°	°								
May 17	Bitumen Sp'gs, near Los Angeles.	Sunrise	51.1	51.1	10.61	10.61	0.00	29.603	751.9	9.53	100		0	None	
17	do	12 m.	69.4	61.7	20.78	16.50	4.28	29.560	750.8	11.37	62	S.W.	2	Cir., 7	
17	do	Sunset	59.9	57.5	15.50	14.16	1.34	29.578	751.3	11.22	87		0	Cir.-cum., 9.	
18	do	Sunrise	57.0	56.5	13.89	13.61	0.28	29.610	752.1	11.41	98		0	Cir.-cum., 10	Slight fall of rain last night; quantity .007in.; misty between 7 & 9 p. m.; appearance of rain throughout the day; evening cloudy.
18	do	12 m.	60.2	57.9	15.66	14.39	1.27	29.665	753.5	11.45	87		0	Cum.-nim., 9	
18	do	Sunset	56.5	55.0	13.61	12.78	0.83	29.677	753.8	10.49	90		0	Cir.-cum.-st., 10.	
19	do	Sunrise	57.0	56.8	13.89	13.78	0.11	29.704	754.5	11.64	100		0	Cir.-cum., 10.	Wind arose S. W. at 1 p. m., continued till sunset; force, (.1); evening clear. Very slight dew last night.
19	do	12 m.	63.0	59.5	17.22	15.28	1.94	29.745	755.5	11.74	81		0	Cir.-cum.-st., 10.	
19	do	Sunset	57.4	56.0	14.11	13.33	0.78	29.727	755.1	10.92	93		0	Cir.-cir.-strat., 7.	
20	do	Sunrise	56.2	56.2	13.44	13.44	0.00	29.724	755.0	11.46	100		0	Cir.-cum., 10.	
20	do	12 m.	65.5	61.0	18.61	16.11	2.50	29.722	754.9	12.11	77	S.W.	1	Cir.-cum , 10.	
20	do	Sunset	59.0	57.9	15.00	14.39	0.61	29.685	754.0	11.85	93		0	Cir.-cum.-st., 10.	
21	do	Sunrise	57.5	56.2	14.16	13.44	0.72	29.703	754.4	11.03	93		0	Cir.-cum.-st., 10.	
21	do	12 m.	67.0	62.0	19.44	16.67	2.77	29.688	754.1	12.45	75		0	Cum., 5	
21	do	Sunset	58.5	55.0	14.72	12.78	1.94	29.662	753.4	9.83	80	S.W.	1	Cir.-stratus, 1	
22	do	Sunrise	56.0	56.0	13.33	13.33	0.00	29.678	753.8	11.39	100		0	Foggy and misty	
2	do	12 m.	70.0	63.5	21.11	17.50	3.61	29.651	753.1	12.66	68	S.W.	1	Cir.-cum., 4	
22	do	Sunset	58.5	55.0	14.72	12.78	1.94	29.606	752.0	9.83	80		0	Cir., 6	
23	do	Sunrise	56.9	56.5	13.83	13.61	0.22	29.596	751.7	11.46	98		0	Foggy and misty	At sunrise thick fog and mist; at sunset very hazy in horizon; wind rose at 11 a. m.; died away at 4 p. m.; evening clear.
23	do	12 m.	70.0	63.9	21.11	17.72	3.39	29.570	751.1	12.98	70	S.W.	2	Cum., 1	
23	do	Sunset	59.0	58.0	15.00	14.44	0.56	29.541	750.3	11.92	95		0	Cir., 2	
24	do	Sunrise	58.0	57.5	14.44	14.16	0.28	29.570	751.1	11.86	98		0	Foggy and misty	
24	do	12 m.	70.0	64.5	21.11	18.05	3.06	29.552	750.6	13.54	73	S.W.	2	Cir., 2	
24	do	Sunset	58.0	56.5	14.44	13.61	0.83	29.543	750.4	11.09	91	S.W.	1	Foggy	
25	do	Sunrise	57.6	57.0	14.22	13.89	0.33	29.543	750.4	11.58	98		0	Cum.-nim., 10.	
25	do	12 m.	65.5	62.5	18.61	16.94	1.67	29.531	750.1	13.36	84		0	Cir.-cum., 10.	
25	do	Sunset	60.0	58.0	15.55	14.44	1.11	29.536	750.2	11.59	89	S.W.	1	Cir.cum., 9	
26	do	Sunrise	57.5	57.0	14.16	13.89	0.27	29.564	750.9	11.62	98		0	Cir.-cum., 10.	

26	----do----------	12 m-----	63.0	60.5	17.22	15.83	1.39	29.598	751.8	12.50	86	S.W ---	2	Cir.-cum., 10 ---	
26	----do----------	Sunset ---	58.0	57.0	14.44	13.89	0.55	29.604	751.9	11.45	95	S.W ---	1	Cir.-cum., 10 ---	
27	----do----------	Sunrise --	57.4	56.9	14.11	13.83	0.28	29.637	752.8	11.57	98	--------	0	Cir.-cum., 10 ---	At sunrise very hazy in horizon;
27	----do----------	12 m-----	65.5	61.0	18.61	16.11	2.50	29.627	752.4	12.11	77	S.W ---	1	Cir.-cum., 9 ----	wind increased at 1 p. m. to 2;
27	----do----------	Sunset ---	58.2	56.0	14.55	13.33	1.22	29.592	751.6	10.68	86	--------	0	Cir.-cum., 10 ---	died away between 4 p. m. and sunset. Evening cloudy.
28	----do----------	Sunrise --	58.2	57.5	14.55	14.16	0.39	29.571	751.1	11.77	95	--------	0	Cir.-cum., 10 ---	Wind rose at 11½ a. m.; died away
28	----do----------	12 m-----	62.0	60.0	16.67	15.55	1.12	29.587	751.5	12.46	89	S.W ---	2	Cir.-cum., 10 ---	between 3 and 6 p. m. Evening cloudy.
28	----do----------	Sunset ---	68.0	66.9	20.00	19.39	0.61	29.540	750.3	16.37	94	--------	0	Cir.-stratus, 2---	
29	----do----------	Sunrise --	56.9	56.0	13.83	13.33	0.50	29.564	750.9	11.09	95	--------	0	Cir.-cum., 7 ----	
29	----do----------	12 m-----	69.0	60.5	20.55	15.83	4.72	29.551	750.6	10.49	59	S.W ---	2	None ----------	
29	----do----------	Sunset ---	59.5	58.0	15.28	14.44	0.84	29.532	750.1	11.75	91	--------	0	None ----------	
30	----do----------	Sunrise --	51.4	51.3	10.78	10.73	0.05	29.550	750.6	9.58	100	--------	0	Cir.-cum., 9 ----	
30	----do----------	12 m-----	70.0	63.9	21.11	17.72	3.39	29.551	750.6	12.98	70	S.W ---	2	None ----------	
30	----do----------	Sunset ---	60.1	58.1	15.60	14.50	1.10	29.536	750.2	11.64	89	--------	0	None ----------	
31	----do----------	Sunrise --	59.0	56.9	15.00	13.83	1.17	29.590	751.6	11.04	89	--------	0	Cir.-cum., 10 ---	During all of this day very hazy in
31	----do----------	12 m-----	70.0	63.0	21.11	17.22	3.89	29.626	752.5	12.24	67	S.W ---	2	Cum., 6--------	horizon; wind sprung up at 11½
31	----do----------	Sunset ---	57.5	56.0	14.16	13.33	0.83	29.625	752.5	10.89	91	--------	0	Cir., 2 ---------	a. m., and died away between 4 and 6 p. m.; evening cloudy.
June 1	----do----------	Sunrise.--	57.0	55.0	13.89	12.78	1.11	29.681	753.9	10.33	89	--------	0	Cir.-cum., 10 --	
1	----do----------	12 m ----	67.4	61.8	19.66	16.55	3.11	29.713	754.7	12.14	72	S. W----	3	Cir.-cum., 2----	
1	----do----------	Sunset ---	59.8	57.1	15.44	13.94	1.50	29.675	753.7	11.00	85	--------	0	Cirrus, 0.5 -----	
2	----do----------	Sunrise --	48.0	47.9	8.89	8.83	0.06	29.722	754.9	8.40	100	--------	0	Cirrus, 3 -------	
2	----do----------	12 m ----	67.2	60.9	19.55	16.06	3.49	29.692	754.2	11.46	68	S. W----	3	Cumulus, 3-----	
2	----do----------	Sunset ---	61.0	57.9	16.11	14.39	1.72	29.688	754.1	11.18	83	--------	0	None ----------	
3	----do----------	Sunrise --	52.9	52.3	11.61	11.28	0.33	29.724	755.0	9.84	97	N. E----	0.5	Cir.-cum., 9 ----	
3	----do----------	12 m ----	68.2	63.0	20.11	17.22	2.89	29.717	754.8	12.85	74	S. W----	2	Cir.-cum., 3 ----	
3	----do----------	Sunset ---	58.6	57.4	14.78	14.11	0.67	29.674	753.7	11.59	93	--------	0	Cir.-cum., 3 ----	

May 17.—At sunrise, sky entirely obscured by thick fog. Wind sprung up at 11½ a. m. and dispelled fog; died away between 5 p. m. and sunset; evening cloudy. Heavy dew last night.

May 20.—At sunrise, air saturated with moisture. Wind sprung up from southwest at 11½ a. m., continued till sunset. Evening at 8 p. m. nearly clear.

May 21.—At sunset, slightly hazy; at 1 p. m. wind increased to 1; died away between 5 p. m. and sunset; evening clear; no dew last night.

May 22.—At sunrise, foggy and misty; at 12 m., slightly hazy in northeast; at sunset, hazy in horizon and foggy in southwest. Wind rose at 10½ a. m.; died away between 5 p. m. and sunset. Evening cloudy.

May 24.—At sunrise, sky obscured by thick fog and mist; at 12 m., slightly hazy in northeast; at sunset, sky covered with thick fog. Wind rose at 9½ a. m.; died away at 8 p. m. Evening cloudy.

May 25.—At sunrise, misty; several slight showers during morning, not sufficient for measurement. Wind rose at 1 p. m. from southwest; force 1; died away between 5 p. m. and half an hour after sunset. Evening cloudy.

May 26.—At sunrise, misty; at 12 m., slightly hazy in horizon. Wind rose at 11½ a. m.; died away two hours after sunset. Day cloudy throughout, and therefore eclipse of sun not observed. Evening cloudy.

May 29.—At 12 m. and sunset, hazy in horizon. Wind increased at 12½ p. m. to 3; died away between 4 and 6 p. m. Evening clear. Slight dew last night.

May 30.—At sunrise, hazy in horizon. Slight breeze from southwest during morning; increased at 11½ a. m. to 3; died away between 6 p. m. and sunset. Evening cloudy; 12 m, hazy in horizon.

June 1.—At the sunset observation, very hazy in horizon. Wind sprung up at 10½ a. m.; subsided between 6 p. m. and sunset. Evening clear. Slight dew last night.

June 2.—During all the observations, very hazy in horizon. Wind rose at 9 a. m; subsided between 6 p. m. and sunset. Evening clear. Heavy dew last night.

June 3.—During all the observations, very hazy in horizon. Wind changed to S. W. at 9 a. m.; subsided between 5 and 6 p. m. Evening cloudy. Slight dew last night.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t-t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1854.			°	°	°	°	°								
June 4	Bitumen Sp'gs, near Los Angeles	Sunrise	56.0	55.1	13.33	12.83	0.50	29.662	753.4	10.73	95		0	Cir.-cum., 10	
4	do	12 m	72.0	64.3	22.22	17.94	4.28	29.658	753.3	12.64	64	S. W	0.5	None	
4	do	Sunset	59.5	58.0	15.28	14.44	0.84	29.622	752.4	11.75	91		0	None	
5	do	Sunrise	57.9	56.6	14.39	13.66	0.73	29.668	753.6	11.18	93		0	Cir.-cum., 10	
5	do	12 m	70.0	62.5	21.11	16.94	4.17	29.660	753.3	11.84	65	S. W	2	Cirrus, 1	
5	do	Sunset	59.5	57.5	15.28	14.16	1.12	29.637	752.8	11.36	89		0	Cirrus, 6	
6	do	Sunrise	57.5	56.5	14.16	13.61	0.55	29.677	753.8	11.26	95		0	Foggy	
6	do	12 m	61.0	57.2	16.11	14.00	2.11	29.742	755.4	10.62	79	S. W	2	Cum.-nim., 10	
6	do	Sunset	59.0	55.5	15.00	13.05	1.95	29.731	755.2	10.02	80		0	Cir.-cum., 3	
7	do	Sunrise	53.0	51.1	11.67	10.61	1.06	29.775	756.3	8.89	86		0	Cir.-cum., 8	During all observations, very hazy in horizon. Wind rose 10 and 11 a m.; subsided 4 and 5 p. m. Evening clear.
7	do	12 m	65.9	57.5	18.83	14.16	4.67	29.761	755.9	9.20	57	S. W	3	None	
7	do	Sunset	60.4	56.5	15.78	13.61	2.17	29.682	753.9	10.34	79		0	None	
8	do	Sunrise	51.2	50.0	10.67	10.00	0.67	29.665	753.5	8.76	93		0	Cirrus, 5	During all observations, very hazy in horizon. Wind rose 10 and 11 a. m. Subsided 4 and 5 p. m. Evening clear.
8	do	12 m	72.0	62.5	22.22	16.94	5.28	29.617	752.3	11.15	56	S. W	2	None	
8	do	Sunset	65.6	61.2	18.66	16.22	2.44	29.555	750.7	12.24	77		0	None	
9	do	Sunrise	51.5	49.5	10.83	9.72	1.81	29.560	750.8	7.91	78		0	None	
9	do	12 m	73.0	64.0	22.78	17.78	5.00	29.548	750.5	12.07	59	S. W	2	None	
9	do	Sunset	64.0	60.5	17.78	15.83	1.95	29.508	749.5	12.17	82		0	None	
10	do	Sunrise	59.0	57.2	15.00	14.00	1.00	29.553	750.6	11.30	89		0	Foggy	
10	do	12 m	79.2	66.9	26.22	19.39	6.83	29.536	750.2	12.59	49	S. W	2	Cumulus, 1	
10	do	Sunset	63.0	60.5	17.22	15.83	1.39	29.512	749.6	12.50	86		0	Cirrus, 8	
11	do	Sunrise	59.6	57.4	15.33	14.11	1.22	29.585	751.4	11.26	87		0	Foggy	At sunrise, thick fog; at 12 m. and sunset, hazy in horizon. Wind rose 11 and 11½ a. m., subsided 3 and 4 p. m. Evening cloudy.
11	do	12 m	75.6	66.5	24.22	19.16	5.06	29.579	751.3	13.42	60	S. W	2	Cir., 8	
11	do	Sunset	60.9	58.9	16.06	14.94	1.12	29.570	751.1	11.98	89		0	Cir., 8	
12	do	Sunrise	59.0	58.0	15.00	14.44	0.56	29.596	751.7	11.92	95		0	Foggy and misty.	At sunrise, foggy and misty; at 12 m. and sunset, hazy in horizon. Few slight gusts from S.W. 3 and 4 p.m. Evening cloudy.
12	do	12 m	66.3	62.0	19.05	16.67	2.38	29.613	752.2	12.68	78	S.E	0.5	Cir.-cum., 10	
12	do	Sunset	63.4	59.1	17.44	15.06	2.38	29.560	750.8	11.30	78		0	Cir.-cum., 3	
13	do	Sunrise	59.0	58.0	15.00	14.44	0.56	29.561	750.8	11.92	95		0	Foggy and misty.	At sunrise and 12 m. foggy, and misty; evening cloudy.
13	do	12 m	65.0	59.1	18.33	15.06	3.27	29.564	750.9	10.76	69		0	None	

13	----do----------	Sunset....	60.1	56.1	15.60	13.39	2.21	29.544	750.4	10.13	76	--------	0	Cir.-cum., 7.----	
14	----do----------	Sunrise...	58.9	56.5	14.94	13.61	1.33	29.578	751.3	10.84	86	--------	0	Cir.-cum., 10.---	At sunrise and 12 m., hazy in horizon. Wind 1 from S.W. between 1 and 6 p. m. Evening clear.
14	----do----------	12 m.....	65.7	59.0	18.72	15.00	3.72	29.593	751.6	10.44	66	--------	0	Cir.-cum., 10.---	
14	----do----------	Sunset....	59.8	56.5	15.44	13.61	1.83	29.586	751.5	10.54	81	--------	0	Cir.-cum., 2.----	
15	----do----------	Sunrise...	56.0	54.5	13.33	12.50	0.83	29.619	752.3	10.30	90	--------	0	Cir.-cum., 10.---	At sunrise, foggy in horiz.; at 12 m. hazy in hor.; sunset very hazy in hor. Wind rose 10 and 10½ a. m. sub. 4 and 5 p. m.; evening clear.
15	----do----------	12 m.....	69.9	61.2	21.06	16.22	4.84	29.604	751.9	10.78	58	S.W ---	2	Cir.-cum., 1.----	
15	----do----------	Sunset....	58.5	56.5	14.72	13.61	1.11	29.562	750.9	10.93	89	--------	0	Cir.-cum., 8.----	
16	----do----------	Sunrise...	55.0	53.9	12.78	12.16	0.62	29.601	751.8	10.19	93	--------	0	Cir.-cum., 10.---	During all observations, hazy in horizon; wind rose 11 and 11½ a. m.; subsided about 1 hour after sunset. Evening cloudy.
16	----do----------	12 m.....	71.5	63.9	21.94	17.72	4.22	29.588	751.5	12.49	64	S.W ---	2	Cir.-cum., 1.----	
16	----do----------	Sunset....	61.0	57.9	16.11	14.39	1.72	29.616	752.2	11.18	83	S.W ---	1	ir.-cum., 0.5.--	
17	----do----------	Sunrise...	58.9	57.0	14.94	13.89	1.05	29.658	753.3	11.15	89	--------	0	Cir.-cum., 10.---	At sunrise fog. in hor.; at 12 m. haz. in hor.; at sunset foggy & hazy. Wind rose 11 & 11½ a.m.; sub. 6 p. m. and sunset. Evening cloudy.
17	----do----------	12 m.....	70.4	62.8	21.33	17.11	4.22	29.671	752.9	11.94	63	S.W ---	3	Cir.-cum., 1.----	
17	----do----------	Sunset....	59.0	57.0	15.00	13.89	1.11	29.603	751.9	11.12	89	--------	0	Cir.-cum., 10.---	
18	----do----------	Sunrise...	58.4	57.0	14.67	13.89	0.78	29.563	750.9	11.31	93	--------	0	Cir.-cum., 10.---	During all observations hazy in horizon; wind rose 11 and 11½ a. m.; subsided 4 and 5 p. m. Evening clear.
18	----do----------	12 m.....	71.0	62.0	21.67	16.67	5.00	29.531	750.1	11.09	57	S.W ---	2	Cir.-cum., 2.----	
18	----do----------	Sunset....	59.6	57.1	15.33	13.94	1.39	29.539	750.3	11.05	85	--------	0	Cir.-cum., 1.----	
19	----do----------	Sunrise...	58.5	57.2	14.72	14.00	0.72	29.538	750.2	11.47	93	--------	0	Cir.-cum., 10.---	At sunrise hazy and foggy; at 12 m. and sunset hazy in horizon. Wind rose 11 and 11½ a. m; sudsided 4 and 5 p. m. Evening clear.
19	----do----------	12 m.....	72.0	64.0	22.22	17.78	4.44	29.566	751.0	12.41	63	S.W ---	2	None ----------	
19	----do----------	Sunset....	61.2	60.0	16.22	15.55	0.67	29.569	751.0	12.73	93	--------	0	Cir.-strat., 1.--	
20	----do----------	Sunrise...	57.0	55.1	13.89	12.83	1.06	29.582	751.4	10.40	89	--------	0	Cir.-cum., 10.---	At sunrise and 12 m. hazy in hor.; at sunset sky entirely obsc'd by fog fm. W.; wind rose 11 & 11½ a m.; sub. 5 p.m. & sunset. Ev. cloudy.
20	----do----------	12 m.....	70.5	64.4	21.39	18.00	3.39	29.604	751.9	13.28	70	S.W ---	2	Cir.-cum., 1.----	
20	----do----------	Sunset....	60.5	60.0	15.83	15.55	0.28	29.585	751.4	12.97	98	--------	0	None ----------	
21	----do----------	Sunrise...	56.8	56.8	13.78	13.78	0.00	29.605	752.0	11.70	100	--------	0	Foggy ---------	
21	----do----------	12 m.....	71.6	65.5	22.00	18.61	3.39	29.594	751.7	13.87	70	S.W.----	2	None ----------	
21	----do----------	Sunset....	60.6	59.5	15.89	15.22	0.67	29.579	751.3	12.46	93	--------	0	None ----------	
22	----do----------	Sunrise...	57.8	56.8	14.33	13.78	0.55	29.596	751.7	11.37	95	--------	0	Foggy ---------	
22	----do----------	12 m.....	74.0	65.6	23.33	18.66	4.67	29.612	752.1	13.16	62	S.W.----	2	None ----------	
22	----do----------	Sunset....	66.1	62.5	18.94	16.94	2.00	29.551	750.6	13.16	81	--------	0	None ----------	
23	----do----------	Sunrise...	54.3	51.3	12.39	10.73	1.66	29.561	750.8	8.61	81	N.N.E..	0.5	None ----------	
23	----do----------	12 m.....	84.0	69.3	28.89	20.72	8.17	29.569	751.0	13.17	45	S.W.----	2	one ----------	
23	----do----------	Sunset....	78.1	68.0	25.60	20.00	5.60	29.485	748.9	13.95	57	--------	0	Cirrus, 4.------	

June 4.—During all the observations, very hazy in horizon. Wind rose 11½ and 12 m; increased 12½ p. m. to 1; subsided 4 and 6 p. m. Evening clear.

June 5.—During all observations, very hazy in horizon. Wind rose 11½ and 12 m.; subsided 4 and 6 p. m. Shortly after sunset, slight breeze sprung from S. W. and continued during evening. Evening cloudy. Slight dew last night.

June 6.—At sunrise, sky entirely obscured by fog and mist. Slight drizzling rain falling. Wind rose 8 and 8½ a. m.; subsided 6 p. m. and sunset. Evening cloudy.

June 9.—During all observations, slightly hazy in horizon. Wind rose 10 and 11 a. m.; subsided 3 and 4 p. m. Evening clear. Heavy dew last night.

June 10.—At sunrise, sky obscured by thick fog. At 12 m. and sunset, slightly hazy in horizon. Wind rose 11 and 11½ a. m.; subsided 3 and 4 p. m. Evening cloudy.

June 21.—At sunrise, sky obscured by fog and mist; at 12 m., hazy in horizon; at sunset, sky in west obscured by fog. Wind rose between 11 and 11½ a. m.; subsided between 6 p. m. and sunset. Evening cloudy.

June 22.—At sunrise, sky obscured by fog; at 12 m. and sunset, hazy in horizon. Wind rose between 11 and 11½ a. m.; subsided between 6 p. m. and sunset. Evening clear.

June 23.—At 12 m. and sunset, slightly hazy in horizon. Wind sprung up from S.W. between 11 and 11½ a. m.; subsided between 4 and 5 p. m. Evening cloudy.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of psychrometer.				Difference $t - t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.										
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.		In inches.	In millimet's			Direction.	Force.		
1854.			°	°	°	°	°								
June 24	Bitumen Sp'gs, near Los Angeles	Sunrise	67.0	61.9	19.44	16.61	2.83	29.498	749.2	12.36	73		0	Cirrus, 6	
24	do	12 m	87.0	68.5	30.55	20.27	10.28	29.514	749.6	11.38	35	S.W.	2	None	
24	do	Sunset	77.0	67.0	25.00	19.44	5.56	29.476	748.7	13.43	57		0	None	
25	do	Sunrise	59.5	56.9	15.28	13.83	1.45	29.476	748.7	10.94	85		0	None	During all observations, hazy in horizon. Wind rose between 11 and 11½ a. m.; subsided between 3 and 5 p. m. Evening clear.
25	do	12 m	81.2	68.5	27.33	20.27	7.06	29.482	748.8	13.36	49	S.W.	2	None	
25	do	Sunset	68.0	62.5	20.00	16.94	3.06	29.451	748.0	12.52	72		0	None	
26	do	Sunrise	60.5	59.1	15.83	15.06	0.77	29.494	749.2	12.18	93		0	Foggy	
26	do	12 m	74.3	65.9	23.50	18.83	4.67	29.529	750.0	13.33	62	S.W.	0.5	None	
26	do	Sunset	64.5	61.0	18.05	16.11	1.94	29,535	750.2	12.46	82		0	None	
27	do	Sunrise	56.9	55.1	13.83	12.83	1.00	29.619	752.3	10.43	89		0	Foggy and misty	
27	do	12 m	69.1	62.0	20.61	16.67	3.94	29.640	752.8	11.74	66	S.W.	1	None	
27	do	Sunset	63.0	60.0	17.22	15.55	1.67	29.609	751.1	12.13	83		0	None	
28	do	Sunrise	48.4	46.9	9.11	8.28	0.83	29.618	752.3	7.66	89		0	None	
28	do	12 m	76.4	64.0	24.66	17.78	6.88	29.612	752.1	10.92	48	S.W.	2	None	
28	do	Sunset	64.4	60.0	18.00	15.55	2.45	29.559	750.8	11.63	76		0	None	
29	do	Sunset	49.0	47.2	9.44	8.44	1.00	29.560	750.8	7.64	86	N.E.	0.8	None	
29	do	12 m	76.9	65.0	24.94	18.33	6.61	29.575	751.2	11.65	49	.W.	2	None	
29	do	Sunset	66.2	64.1	19.00	17.83	1.17	29.529	750.0	14.46	90		0	None	
30	do	Sunrise	58.3	56.0	14.61	13.33	1.28	29.523	749.9	10.64	86		0	None	
30	do	12 m	83.8	68.5	28.78	20.27	8.51	29.519	749.8	12.47	43	S.W.	3	None	
30	do	Sunset	68.0	63.4	20.00	17.44	2.56	29.473	748.6	13.25	77		0	None	
July 1	do	Sunrise	61.5	59.5	16.39	15.28	1.11	29.525	749.9	12.25	89		0	Foggy	
1	do	12 m	76.0	61.5	24.44	16.39	8.05	29.559	750.8	8.98	39	S.W	1	None	
1	do	Sunset	64.0	60.5	17.78	15.83	1.95	29.569	751.0	12.17	82		0	None	
2	do	Sunrise	62.4	59.2	16.89	15.11	1.78	29.626	752.5	11.71	83		0	Cir.-cum., 9	At sunset, hazy in horizon. Wind rose between 10 and 11 a. m.; subsided between 6 and 9 p. m. Evening clear.
2	do	12 m	75.0	64.5	23.89	18.05	5.84	29.627	752.5	11.84	54	S.W	3	None	
2	do	Sunset	63.0	59.5	17.22	15.28	1.94	29.580	751.3	11.74	81	S.W	1	None	
3	do	Sunrise	53.2	51.9	11.78	11.05	0.73	29.604	751.9	9.38	93		0	None	
3	do	12 m	77.4	66.1	25.22	18.94	6.28	29.572	751.1	12.45	53	S.W	2	None	
3	do	Sunset	63.0	59.5	17.22	15.28	1.94	29.510	749.5	11.74	81		0	None	

4	----do----------	Sunrise --	59.5	58.0	15.28	14.44	0.84	29.528	750.0	11.75	91	--------	0	Foggy ---------	
4	----do----------	12 m-----	76.8	66.0	24.89	18.89	6.00	29.515	749.7	12.58	54	S.W ---	2	None ----------	
4	----do----------	Sunset ---	62.0	60.0	16.67	15.55	1.12	29.513	749.6	12.47	89	--------	0	None ----------	
5	----do----------	Sunrise --	59.5	57.5	15.28	14.16	1.12	29.506	749.4	11.36	89	--------	0	Foggy ---------	At sunrise, fog ; at 12 m. and sunset, hazy in horizon. Wind rose between 10 and 11 a. m.; subsided between 4 and 6 p. m. Evening cloudy.
5	----do----------	12 m-----	71.7	63.5	22.05	17.50	4.55	29.519	749.8	12.09	62	S.W ---	1	None ----------	
5	----do----------	Sunset ---	61.9	57.2	16.61	14.00	2.61	29.506	749.4	10.33	73	--------	0	None ----------	
6	----do----------	Sunrise --	59.5	57.5	15.28	14.16	1.12	29.538	750.2	11.36	89	--------	0	Foggy ---------	
6	----do----------	12 m-----	71.0	60.9	21.67	16.06	5.61	29.547	750.5	10.08	53	S.W ---	2	None ----------	
6	----do----------	Sunset ---	61.5	58.9	16.39	14.94	1.45	29.502	749.3	11.78	85	--------	0	None ----------	
7	----do----------	Sunrise --	59.5	58.0	15.28	14.44	0.84	29.492	749.1	11.75	91	--------	0	Foggy ---------	At sunrise, fog ; at 12 m. hazy in horizon. Wind rose between 11 a. m. and 12 m.; subsided between 4 and 6 p. m. Ev'g clear.
7	----do----------	12 m-----	78.0	66.8	25.55	19.33	6.22	29.566	751.0	12.90	53	S.W ---	2	Cir., 2 ---------	
7	----do----------	Sunset ---	59.2	56.2	15.11	13.44	1.67	29.581	751.4	10.50	82	--------	0	None ----------	
8	----do----------	Sunrise --	59.2	55.2	15.11	12.89	2.22	29.601	751.8	9.73	76	--------	0	None ----------	During all observations, very hazy. Wind rose between 10 a. m. and 12 m.; subsided between 4 and 6 p. m. Evening clear.
8	----do----------	12 m-----	77.0	66.5	25.00	19.16	5.84	29.635	752.7	12.95	55	S.W ---	2	None ----------	
8	----do----------	Sunset ---	54.0	61.0	17.78	16.11	1.67	29.663	753.4	12.62	84	--------	0	None ----------	
9	----do----------	Sunrise --	58.7	57.5	14.83	14.16	0.67	29.683	753.9	11.63	93	--------	0	None ----------	During all observations, very hazy. Wind rose between 10 and 11 a. m.; subsided between 4 and 6 p. m. Evening clear.
9	----do----------	12 m-----	79.5	65.9	26.39	18.83	7.56	29.659	753.3	11.56	46	S.W ---	2	Cum., 0.5 ------	
9	----do----------	Sunset ---	67.8	62.5	18.89	16.94	2.95	29.616	752.2	12.58	74	--------	0	Cir., 7 ---------	
10	----do----------	Sunrise --	63.8	60.5	17.67	15.83	1.84	29.619	752.3	12.24	82	--------	0	Cir., 4 ---------	
10	----do----------	12 m-----	90.8	72.5	32.67	22.50	10.17	29.630	752.6	14.00	38	S.W ---	1	Cir., 3 ---------	
10	----do----------	Sunset ---	78.5	70.5	25.83	21.39	4.44	29.621	752.4	16.24	65	--------	0	Cir.-strat. eir.-eum., 7.	
11	----do----------	Sunrise --	72.0	68.0	22.22	20.00	2.22	29.621	752.4	16.03	81	--------	0	Cir.-cir.-strat., 8.	
11	----do----------	12 m ----	92.0	70.9	33.33	21.61	11.72	29.628	752.5	12.02	32	S. W---	1	Cir.-eum. & eir.-strat., 10.	
11	----do----------	Sunset ---	75.0	67.5	23.89	19.72	4.17	29.608	752.0	14.58	67	--------	0	Cir., 4 ---------	

July 23.—At sunrise, slightly hazy in horizon ; at sunset hazy in horizon. Wind rose between 11 and 11½ a. m.; subsided between 4 and 6 p. m. Evening clear.

June 26.—At sunrise, sky obscured by fog; at 12 m. and sunset, very hazy in horizon. Wind rose between 11½ a. m. and 1 p. m.; subsided between 3 and 4 p. m.; foree, from 1 to 3 p. m., (1.) Evening clear.

June 27.—At sunrise, foggy and misty ; at 12 m. and sunset, very hazy in horizon. Wind rose between 11 a. m. and 12 m.; subsided between 3 and 5 p. m. Evening clear.

June 28.—Al 12 m. and sunset, slightly hazy in horizon. Wind rose between 11 a. m. and 12 m.; subsided between 4 and 5 p. m. Evening clear. Heavy due last night.

June 29.—At sunrise, slightly hazy; at 12 m., hazy; at sunset, very hazy. Wind continued from N.E till 8 or 9 a. m.; rose from S.W. between 11 and 12 m.; subsided between 3 and 6 p. m. Evening clear.

June 30.—During all observations, hazy in horizon. Wind rose at 9 or 10 a. m. ; subsided between 3 and 6 p. m. Evening clear. Noticed from 8 to 10 p. m. eight to ten shooting stars, starting from different points of heavens, and mostly passing from W. to E.—being visible for a few seconds only.

July 1.—At sunrise and sunset, fog from west; at 12 m., hazy. Wind rose between 10 and 11 a. m. ; subsided between 3 and 6 p. m. Evening clear after 8 p. m. Noticed about 9 p. m. a very brilliant meteor starting from near zenith, proceeding east about 5°, and disappeared as though with explosion.

July 3.—During all observations, very hazy in horizon. Wind rose between 10 and 11 a. m.; subsided between 4 p. m. and sunset. Evening clear.

July 4.—At sunrise and sunset, fog from west; at 12 m., slightly hazy in horizon Wind rose between 10 and 11 a. m.; subsided between 4 and 6 p. m. Evening cloudy.

July 6.—At sunrise and sunset, fog ; at 12 m., hazy in horizon. Wind rose between 10 and 11 a. m.; subsided between 5 p. m. and sunset. Evening cloudy.

July 10.—During all observations, hazy. Wind rose between 10½ and 11 a. m.; subsided between 4 and 6 p. m.; evening clear. Faint flashes of lightning and distant thunder in northeast at 8 and 10 p. m.

July 11.—During all observations, hazy; wind rose between 10 a. m. and 12 m. ; subsided between 3 p. m. and sunset. Slight shower at 3 p. m. of 15 m. duration, insufficient for measurement. Evening clear.

PSYCHROMETRIC AND CLIMATOLOGICAL OBSERVATIONS—Continued.

Date.	Station.	Hour.	Reading of pyschrometer.				Difference $t-t'$.	Reading of barometer.		Force of vapor.	Relative humidity.	Wind.		Clouds.	Remarks.
			Fahrenheit.		Centigrade.			In inches.	In millimet's			Direction.	Force.		
			Dry bulb.	Wet bulb.	Dry bulb. t.	Wet bulb. t'.									
1854.			°	°	°	°	°								
July 12	Bitumen Sp'gs, near Los Angeles	Sunrise	71.5	62.5	21.94	16.94	5.00	29.604	751.9	11.33	58	N. E.	1	Cir., 1	During all observat'ns, hazy; wind changed to S.W. 10½ a. m. and 11 a. m.; subsided 4 and 6 p. m. Evening clear.
12	----do	12 m	91.2	72.2	32.89	22.33	10.56	29.575	751.2	13.55	37	S. W.	2	Cum., 2	
12	----do	Sunset	73.0	64.2	22.78	17.89	4.89	29.531	750.1	12.24	60		0	Cir.-cum., 2	
13	----do	Sunrise	71.9	63.7	22.17	17.61	4.56	29.522	749.8	12.19	62		0	None	During all observations, very hazy; wind rose 10 and 11 a. m.; subsided 4 and 6 p. m. Ev'g clear.
13	----do	12 m	95.2	74.5	35.11	23.61	11.50	29.489	749.0	14.58	34	S. W.	2	Cum., 1	
13	----do	Sunset	76.2	68.2	24.55	20.11	4.44	29.500	749.3	14.79	65		0	None	
14	----do	Sunrise	66.2	61.0	19.00	16.11	2.89	29.491	749.1	11.88	73		0	None	At 12 m. and sunset, slightly hazy in horizon; wind rose 10 and 11 a. m.; subsided 4 and 6 p. m. Evening clear.
14	----do	12 m	96.5	75.5	35.83	24.16	11.67	29.496	749.2	15.20	35	S. W.	2	None	
14	----do	Sunset	70.0	65.5	21.11	18.61	2.50	29.538	750.2	14.44	78		0	Cir., 2	
15	----do	Sunrise	62.0	59.0	16.67	15.00	1.67	29.556	750.7	12.29	93		0	Foggy	At sunrise, sky obscured by fog. At 12 m. and sunset, very hazy; wind rose 11 a. m. & 12 m.; subsided 4 & 6 p.m. Evening foggy.
15	----do	12 m	80.2	68.0	26.78	20.00	6.78	29.583	751.4	13.23	52	S. W.	1	None	
15	----do	Sunset	64.2	61.5	17.89	16.39	1.50	29.562	750.9	12.97	86		0	None	
16	----do	Sunrise	62.0	59.6	16.67	15.33	1.34	29.581	751.3	12.15	87		0	Foggy	At sunrise, sky obscured by fog. At 12 m., hazy; at sunset, very hazy; wind rose 11 a.m. & 12 m.; subsided 5 & 8 p.m. Ev'ng clear.
16	----do	12 m	75.0	65.5	23.89	18.61	5.28	29.578	751.3	12.73	58	S. W.	3	None	
16	----do	Sunset	63.0	60.0	17.22	15.55	1.67	29.554	750.7	12.13	83	S. W.	2	None	
17	----do	Sunrise	63.5	62.0	17.50	16.67	0.83	29.641	752.9	13.63	92		0	Foggy	At sunrise, sky obscured by fog. At 12 m. and sunset, hazy; wind rose 10 and 11 a. m., and subsided 4 & 6 p. m. Ev'ng clear.
17	----do	12 m	77.5	66.9	25.28	19.39	5.89	29.638	752.8	13.17	55	S. W.	3	None	
17	----do	Sunset	63.8	61.6	17.67	16.44	1.23	29.632	752.6	13.17	88		0	None	
18	----do	Sunrise	62.6	61.9	17.00	16.61	0.39	29.685	754.0	13.84	96		0	Foggy	At sunrise, sky obscured by fog. At 12 m. and sunset, hazy; wind rose 10 and 11 a. m.; subsided 4 and 5 p. m. Evening clear.
18	----do	12 m	76.1	66.0	24.50	18.89	5.61	29.696	754.3	12.82	56	S. W.	1	None	
18	----do	Sunset	66.9	63.4	19.39	17.44	1.95	29.651	753.1	13.62	83		0	None	
19	----do	Sunrise	59.2	58.0	15.11	14.44	0.67	29.670	753.6	11.85	93		0	Foggy	At sunrise, sky obscured by fog. At 12 m. and sunset, hazy; wind rose 10 and 11 a. m.; subsided 4 and 5 p. m. Evening clear.
19	----do	12 m	75.9	68.0	24.39	20.00	4.39	29.660	753.3	14.69	65	S. W.	2	Cir., 2	
19	----do	Sunset	69.8	62.5	21.00	16.94	4.06	29.622	753.4	11.91	65		0	None	
20	----do	Sunrise	63.1	60.0	17.28	15.55	1.73	29.592	751.6	12.09	83		0	Foggy	
20	----do	12 m	75.9	67.0	24.39	19.44	4.95	29.593	751.6	13.79	61	S. W.	2	None	
20	----do	Sunset	66.2	63.0	19.00	17.22	1.78	29.564	750.9	13.52	84		0	None	
21	----do	Sunrise	59.5	58.5	15.28	14.72	0.56	29.605	752.0	12.14	96		0	Foggy	At sunrise, sky obscured by fog; at 12 m., hazy; wind rose 10 and 11
21	----do	12 m	79.5	70.0	26.39	21.11	5.28	29.580	751.3	15.38	60	S.W.	2	Cir., 7	

21	----do----------	Sunset---	68.9	63.6	20.50	17.55	2.95	29.556	750.7	13.11	74	--------	0	Cir., 5.---------- a. m; subsided 4 and 6 p. m Evening clear.
22	----do----------	Sunrise---	60.1	58.2	15.60	14.55	1.05	29.609	752.1	11.71	89	--------	0	Foggy---------- At sunrise, sky obscured by fog; at
22	----do----------	12 m.-----	84.0	71.4	28.89	21.89	7.00	29.586	751.5	15.25	52	S.W---	2	Cir.-cum., 7.----- 12 m,. hazy; wind rose 10 and
22	----do----------	Sunset---	69.6	66.0	20.89	18.89	2.00	29.547	750.5	15.02	82	--------	0	Cir., 4.---------- 11 a. m.; subsided 4 and 6 p. m. Evening clear.
23	----do----------	Sunrise---	61.8	60.4	16.55	15.78	0.77	29.565	750.9	12.85	94	--------	0	Cir., 5.---------- At 12 m., slightly hazy; wind rose
23	----do----------	12 m.-----	84.5	73.5	29.16	23.05	6.11	29.582	751.4	17.19	58	S.W---	3	Cir.-cum., 3.----- 10 and 11 a. m.; subsided 4 and
23	----do----------	Sunset---	73.0	67.6	22.78	19.78	3.00	29.535	750.2	15.29	74	--------	0	Cir., 3.---------- 6 p. m. Evening clear.
24	----do----------	Sunrise---	66.9	66.0	19.39	18.89	0.50	29.633	752.7	15.94	96	--------	0	Foggy----------
24	----do----------	12 m.-----	80.4	72.0	26.89	22.22	4.67	29.597	751.7	17.05	65	S.W---	4	Cir.-cum., 7.-----
24	----do----------	Sunset---	73.5	68.5	23.05	20.27	2.78	29.565	750.9	15.98	77	--------	0	Cir.-cum.-nim., 9
25	----do----------	Sunrise---	67.4	66.2	19.66	19.00	0.66	29.621	752.4	15.95	94	--------	0	Foggy----------
25	----do----------	12 m.-----	87.4	72.5	30.77	22.50	8.27	29.596	751.7	15.17	46	N.E.---	2	Cir.-cum.-nim., 9
25	----do----------	Sunset---	71.0	64.2	21.67	17.89	3.78	29.580	751.3	12.91	69	--------	0	Cum., 2---------
26	----do----------	Sunrise---	67.1	66.0	19.50	18.89	0.61	29.622	752.4	15.88	94	--------	0	Foggy---------- At sunrise, sky obsc. by fog; at 12
26	----do----------	12 m.-----	80.5	71.0	26.94	21.67	5.27	29.627	752.5	16.06	60	S.W---	2	Cum., 9--------- m. very hazy; sunset hazy; wind
26	----do----------	Sunset---	68.6	66.5	20.33	19.16	1.17	29.613	752.2	15.79	91	--------	0	Cir., 5.---------- rose 9 and 10 a. m.; subsided 4 and 6 p. m. Evening clear.
27	----do----------	Sunrise---	64.4	63.5	18.00	17.50	0.50	29.664	753.4	14.57	96	--------	0	Foggy---------- At sunrise sky obsc. by fog; at 12 m.
27	----do----------	12 m.-----	79.3	65.0	26.28	18.33	7.95	29.658	753.3	10.82	43	S.W---	2	Cum., 2--------- slightly hazy; sunset very hazy;
27	----do----------	Sunset---	69.0	67.0	20.55	19.44	1.11	29.637	752.8	16.11	91	--------	0	Cum., 1--------- wind rose 10 and 11 a. m.; sub. 4 and 6 p. m. Evening clear.
28	----do----------	Sunrise---	65.4	64.0	18.55	17.78	0.77	29.680	753.9	14.65	94	--------	0	None ---------- At sunrise, very hazy; at 12 m.
28	----do----------	12 m.-----	82.8	69.8	28.22	21.00	7.22	29.656	753.2	14.06	50	S.W---	2	Cum., 2--------- hazy; wind rose 10 and 11 a. m.;
28	----do----------	Sunset---	69.8	67.8	21.00	19.89	1.11	29.608	752.0	16.56	91	--------	0	None ---------- subsided 4 and 6 p. m. Evening clear.
29	----do----------	Sunrise---	64.0	63.0	17.78	17.22	0.56	29.616	652.3	14.28	96	--------	0	Foggy----------
29	----do----------	12 m.-----	76.0	66.0	24.44	18.89	5.55	29.612	752.1	12.85	57	S.W---	2	None ----------
29	----do----------	Sunset---	63.8	60.0	17.67	15.55	2.12	29.601	751.8	11.85	80	--------	0	Foggy----------
30	----do----------	Sunrise---	62.6	61.4	17.00	16.33	0.67	29.566	751.0	13.43	94	--------	0	Foggy---------- At sunrise, sky obsc. by fog; at 12
30	----do----------	12 m.-----	77.0	68.0	25.00	20.00	5.00	29.574	751.2	14.32	61	S.W---	2	None ---------- m. and sunset, very hazy; wind
30	----do----------	Sunset---	65.8	63.0	10.78	17.22	1.56	29.554	750.7	13.67	86	--------	0	None ---------- rose 10 and 11 a. m.; subsided 4 and 6 p m. Evening clear.
31	----do----------	Sunrise---	64.0	62.2	17.78	18.78	1.00	29.649	753.1	13.63	90	--------	0	Foggy----------
31	----do----------	12 m.-----	75.7	65.9	24.27	18.83	5.44	29.638	752.8	12.86	57	S.W---	2	None ----------
31	----do----------	Sunset---	65.0	64.0	18.33	17.78	9.55	29.643	752.9	14.79	96	--------	0	None ----------

July 20.—At sunrise, sky observed by thick fog. At 12 m., hazy; at sunset, slightly hazy. Wind rose 10 and 11 a. m.; subsided 4 and 6 p. m Evening clear.

July 24.—At sunrise, sky obscured by fog; at 12 m., hazy; wind rose 10 and 11 a. m.; subsided 4 and 6 p. m.; two slight showers 9 and 10 p. m. Thunder, lightning, and rain in S.W. during afternoon. Evening clear.

July 25.—At sunrise, sky obscured by fog; wind rose 8 and 9 a. m.; changed to S.W. 3 and 4 p. m.; subsided 5 p. m. and sunset; slight shower 8 and 9 a. m.; heavy thunder 8 to 11 a. m. Evening clear.

July 29.—At sunrise, sky obscured by fog; same at sunset; at 12 m., hazy; wind rose between 10 and 11 a. m.; subsided 4 and 6 p. m. Evening cloudy. Fog from W. half hour before sunset.

July 31.—At sunrise, sky obscured by fog; at sunset, very hazy; wind rose 11 and 12 m.; subsided 4 and 6 p. m. Fog came from W. 7 and 8 p. m.; until that time clear.

APPENDIX I.

BAROMETRIC AND METEOROLOGICAL OBSERVATIONS.

NOTE.—The numbers in column 8 give the reading of barometer reduced to equivalent at 32° temperature, and corrected for constant error of instrument for horary variation. Column 9 contains the mean of the results for each station, corrected for the abnormal change.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Napoleon, Ark...	June 24	11 a. m...	781	30.296	77	.....	30.117	.....	N.E....	0.1	Cir. & nim., 10.
			785	.278	76.6	.....	.120	.....	N.E....	0.1	....do.....
			790	.250	77	.....	.121	.....	N.E....	0.1	....do.....
			783	.283	77.1	.....	.111	.....	N.E....	0.1	....do.....
			784	.289	78	.....	.114	29.900	N.E....	0.1	....do.....
Little Rock, Ark..	June 27	8¾ a. m...	781	29.984	79.2	.....	29.804	.....	W.....	0.2	Cir. & nim., 1.
			783	.966	78.8	.....	.793	.....	W.....	0.2	....do.....
			785	.957	79	.....	.796	.....	W.....	0.2	....do.....
			784	.964	79.3	.....	.791	.....	W.....	0.2	....do.....
			790	.928	79.3	.....	.798	.....	W.....	0.2	....do.....
		12½ p. m..	781	.966	86.9	.....	.768	.....	.....	.....	.....
			783	.957	86.9	.....	.766	.....	.....	.....	.....
			785	.942	87	.....	.763	.....	.....	.....	.....
			784	.953	87	.....	.762	.....	.....	.....	.....
			790	.910	87.1	.....	.762	.....	.....	.....	.....
		6 p. m....	781	.906	90.1	.....	.725	.....	.....	.....	.....
			783	.900	90	.....	.726	.....	.....	.....	.....
			785	.880	89.5	.....	.719	.....	.....	.....	.....
			784	.888	90.2	.....	.714	.....	.....	.....	.....
			790	.847	90	.....	.716	.....	.....	.....	.....
		9¾ p. m...	781	.879	84.8	.....	.699	.....	.....	0.3	Cir. & nim., 5.
			783	.874	83	.....	.706	.....	.....	0.3	....do.....
			785	.859	84	.....	.700	.....	.....	0.3	....do.....
			784	.864	84.7	.....	.688	.....	.....	0.3	....do.....
			790	.830	83.5	.....	.704	.....	.....	0.3	....do.....
Do.....	June 28	7 a. m....	781	.931	79.5	.....	.758	.....	.....	.....	.....
			783	.899	79.5	.....	.733	.....	.....	.....	.....
			785	.916	79.5	.....	.763	.....	.....	.....	.....
			784	.924	79.5	.....	.756	.....	.....	.....	.....
			790	.907	79.1	.....	.785	.....	.....	.....	.....
		10¾ a. m..	781	.953	85.6	.....	.752	.....	S.....	0.1	Cumulus, 4...
			783	.950	85.8	.....	.754	.....	S.....	0.1	....do.....
			785	.929	85.3	.....	.748	.....	S.....	0.1	....do.....
			784	.954	85.8	.....	.758	.....	S.....	0.1	....do.....
			790	.913	85.8	.....	.780	.....	S.....	0.1	....do.....

June 24.—11 a. m., showery.
June 27.—Fair ; light breeze ; few clouds.

NOTE.—The observations taken at Cincinnati and other points not used in the computations are omitted. They may be found in the note-books.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Little Rock, Ark..	June 28	6½ p. m...	781	29.875	89.5	.....	29.693	.....	.....	0	None .....
			783	.876	89.8	.....	.701	.....	.....	0	None .....
			785	.860	91.3	.....	.694	.....	.....	0	None .....
			784	.860	89.6	.....	.684	.....	.....	0	None .....
			790	.827	89.7	.....	.696	.....	.....	0	None .....
		12 p. m...	781	.859	79.9	.....	.684	.....	.....	0	None .....
			783	.859	79.8	.....	.691	.....	.....	0	None .....
			785	.849	79.9	.....	.690	.....	.....	0	None .....
			784	.847	79.9	.....	.679	.....	.....	0	None .....
			790	.825	80	.....	.700	.....	.....	0	None .....
Do.....	June 29	7.20 a. m..	781	.899	79	.....	.725	.....	.....	0	None .....
			783	.881	78.5	.....	.715	.....	.....	0	None .....
			785	.876	79.4	.....	.720	.....	.....	0	None .....
			784	.883	79.2	.....	.716	.....	.....	0	None .....
			790	.855	78.8	.....	.731	.....	.....	0	None .....
		11.30 a. m..	781	.919	88	.....	.710	.....	.....	0	None .....
			783	.917	87.6	.....	.716	.....	.....	0	None .....
			785	.909	87.1	.....	.721	.....	.....	0	None .....
			784	.915	88.1	.....	.713	.....	.....	0	None .....
			790	.882	87.9	.....	.723	29.680	.....	0	None .....
*Fort Smith.....	July 4	1.50 p. m...	781	29.755	85.3	.....	29.568	.....	.....	0	None .....
			783	.744	85.6	.....	.566	.....	.....	0	None .....
			785	.734	85.3	.....	.568	.....	.....	0	None .....
			784	.753	85.9	.....	.574	.....	.....	0	None .....
			790	.708	85.8	.....	.574	.....	.....	0	None .....
		4.45 p. m...	781	.748	86.5	.....	.577	.....	.....	0	None .....
			783	.731	85.6	.....	.571	.....	.....	0	None .....
			785	.725	85.8	.....	.578	.....	.....	0	None .....
			784	.741	86	.....	.580	.....	.....	0	None .....
			790	.691	86.3	.....	.572	.....	.....	0	None .....
Do.....	July 5	8.35 a. m...	781	.823	78.5	.....	.645	.....	.....	0	None .....
			783	.809	78.6	.....	.635	.....	.....	0	None .....
			785	.816	78.7	.....	.655	.....	.....	0	None .....
			784	.816	78.9	.....	.643	.....	.....	0	None .....
			790	.769	78.5	.....	.642	.....	.....	0	None .....
		12.19 p. m..	781	.808	84	.....	.618	.....	.....	0	None .....
			785	.787	84.8	.....	.618	.....	.....	0	None .....
			784	.802	84.3	.....	.620	.....	.....	0	None .....
			790	.760	84.2	.....	.625	.....	.....	0	None .....
		10.15 p. m..	781	.783	78.9	.....	.618	.....	.....	0	None .....
			785	.755	79.6	.....	.610	.....	.....	0	None .....
			784	.782	79.3	.....	.622	.....	.....	0	None .....
			790	.733	78.4	.....	.618	.....	.....	0	None .....
Do.....	July 6	8.15 a. m...	781	.843	78.2	.....	.664	.....	.....	0.3	Cumulus, 5...
			785	.814	78.3	.....	.655	.....	.....	0.3	....do.....
			784	.828	78.4	.....	.656	.....	.....	0.3	....do.....
			790	.787	77.9	.....	.660	.....	.....	0.3	....do.....

June 28.—Clear and calm.
29.—Clear and calm.

July 4.—Clear and calm.
5.—Clear and calm.

* Dr. Shumard, geologist and naturalist upon the exploring expedition of Capt. Marcy, furnished us with the accompanying series of thermometrical observations made at Fort Smith. They are of particular interest in the determination of the character of the climate at this place. For the year ending June 1, 1852, the mean temperature was 65°.47. The mean for August, the warmest month, was 89°.4. The lowest, 34°.84, was the mean for January. But one storm of snow was recorded during the year; that was two inches, in January. Rain occurred every month; the least in September, October, and January, averaging one and one-third inches. May appears to be the rainy season—twelve and one-sixteenth inches having been measured during the month. For the year the fall recorded was fifty-one and one-fourth inches. There were two hundred and nineteen moist days, eighty-two of which were rainy, and one hundred and twenty-six dry days; twenty not having been noted. The mean temperature of the summer was 86°.98; of autumn, 69°.11; of winter, 42°.28; of spring, 63°.57. The highest temperature recorded was 104°, in August; the lowest, 4°, in January. The summer referred to is that during which the place was visited by the cholera.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Fort Smith	July 6	2 p. m.	781	29.790	86.2		29.604			0	None
			785	.761	81		.606			0	None
			784	.774	81		.608			0	None
			790	.734	86.3		.600			0	None
		9 p. m.	781	.832	78.2		.774			0.3	Cumulus, 5
			785	.823	78.1		.685			0.3	do
			784	.846	77.9		.694			0.3	do
			790	.792	78		.684			0.3	do
Do	July 7	9½ a. m.	781	.867	81.6		.676				
			785	.842	81.3		.670				
			784	.860	81.4		.676				
			790	.812	81.6		.672				
		12¼ p. m.	781	.837	85.5		.646		N.W.	0.2	Cumulus, 2
			785	.842	84.9		.652		N.W.	0.2	do
			784	.845	84.9		.663		N.W.	0.2	do
			790	.786	85.2		.646		N.W.	0.2	do
		3¼ p. m.	781	.819	88		.633		N.W.	0.2	Cumulus, 3
			785	.791	87.1		.628		N.W.	0.2	do
			784	.818	87.1		.644		N.W.	0.2	do
			790	.755	87.6		.623		N.W.	0.2	do
		6.10 p. m.	781	.813	85.1		.644		N.N.W.	1	None
			785	.808	85		.659		N.N.W.	1	do
			784	.819	85.3		.658		N.N.W.	1	do
			790	.770	85.2		.651		N.N.W.	1	do
Do	July 8	9½ a. m	781	.889	83.8		.690		N.W.	3	Cumulus, 1
			783	.883	84		.694		N.W.	3	do
			785	.871	83		.695		N.W.	3	do
			784	.892	88.3		.735		N.W.	3	do
			790	.835	83.4		.690		N.W.	3	do
		3.15 p. m.	781	.783	87.9		.595		N	1	Cumulus, 2
			783	.779	87.3		.604		N	1	do
			785	.770	87.4		.606		N	1	do
			784	.786	87.3		.617		N	1	do
			790	.736	88.1		.601		N	1	do
		6¼ p. m.	781	.778	80.6		.621		N	1	Nimbus, 8
			783	.762	80.6		.611		N	1	do
			785	.749	80.4		.613		N	1	do
			784	.775	80.5		.626		N	1	do
			790	.716	80.2		.611		N	1	do
Do	July 9	9 a. m	781	.830	79.8		.644		S.S.W.	2	Nimbus, 7
			783	.805	79		.629		S.S.W.	2	do
			785	.796	79.3		.631		S.S.W.	2	do
			784	.815	79.6		.638		S.S.W.	2	do
			790	.767	79.1		.634		S.S.W.	2	do
		12 m	781	.790	78.6		.616		S	3	Nimbus, 9
			783	.791	78.5		.625		S	3	do
			785	.774	78.9		.618		S	3	do
			784	.896	78.6		.729		S	3	do
			790	.742	77.8		.619		S	3	do
		3 p. m.	781	.761	82.4		.589		S.E.	1	Nimbus, 9
			783	.746	81.8		.582		S.E.	1	do
			785	.740	82		.588		S.E.	1	do
			784	.759	82		.596		S.E.	1	do
			790	.703	81.8		.584		S.E.	1	do
		5¾ p. m.	781	.745	77.2		.598		S.S.E.	1	Nimbus, 9
			783	.743	77.1		.603		S.S.E.	1	do
			785	.729	77.8		.602		S.S.E.	1	do
			784	.737	77.3		.697		S.S.E.	1	do
			790	.699	78		.600		S.S.E.	1	do

July 6.—Light breeze and few clouds.
July 7.—Light breeze and few clouds.
July 8.—6 p. m., showery.
July 9.—12 m., showery; 3 and 5¾ p. m. do.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Fort Smith	July 11	9½ a. m	781	29.770	80.6	------	29.582	------	N. W	1	Nimbus, 2
			783	.768	80.3	------	.588	------	N. W	1	do
			785	.752	80.5	------	.584	------	N. W	1	do
			784	.751	80.6	------	.575	------	N. W	1	do
			790	.718	80.6	------	.581	------	N. W	1	do
		12 m	781	.757	83.2	------	.591	------	S.W	1	Nimbus, 3
			783	.755	82.5	------	.578	------	S.W	1	do
			785	.741	82.8	------	.577	------	S.W.	1	do
			784	.667	82.8	------	.491	------	S.W	1	do
			790	.710	82.5	------	.577	------	S.W	1	do
		2½ p. m	781	.709	85.2	------	.526	------	S.W	0	Nimbus, 1
			783	.696	85	------	.526	------	S.W	0	do
			785	.679	85	------	.520	------	S.W	0	do
			784	.688	85.4	------	.508	------	S.W	0	do
			790	.650	85.1	------	.521	------	S.W	0	do
		6 p. m	781	.692	84.8	------	.525	------	------	0	None
			783	.681	84.2	------	.524	------	------	0	None
			785	.654	84.6	------	.520	------	------	0	None
			784	.779	84	------	.621	------	------	0	None
			790	.638	84.6	------	.522	------	------	0	None
Do	July 12	9 a. m	781	------	------	------	------	------	N.N.W.	1	Nim. & cir., 2
			783	.748	79	------	.572	------	N.N.W.	1	do
			785	.726	79	------	.568	------	N.N.W.	1	do
			784	.720	78.9	------	.544	------	N.N.W.	1	do
			790	.696	79	------	.563	------	N.N.W.	1	do
		12½ p. m	783	.737	83.7	------	.560	------	------	0	Cumulus, 5
			785	.726	83	------	.564	------	------	0	None
			784	.724	83.9	------	.542	------	------	0	None
			790	.690	83.5	------	.554	29.560	------	0	None
Camp Wilson	do	8½ a. m	781	29.755	79.1	------	------	------	N.N.W.	1	Nim. & cum., 1
		12 m	------	.774	87.8	28.3c	------	------	------	0	Cumulus, 3
		3 p. m	------	.733	88.3	27.5c	------	------	------	0	Cumulus, 3
		6 p. m	------	.708	83.5	27.4	------	------	------	0	None
Do	July 13	8 a. m	781	.798	79.7	26.1c	.617	------	N.N.W.	1	None
		10½ a. m	781	.816	85.8	29.9c	.615	------	N.N.W.	1	Cumulus, 1
		12 m	781	.795	90.1	32.4c	.592	------	S.W	3	Nim. & cum., 4
		2 p. m	781	.758	88.9	30.8c	.572	------	S	1	Nim. & cum., 3
		4 p. m	781	.725	78.5	26 c	.577	------	S.E.	2	Nimbus, 8
		6 p. m	781	.733	83.2	28.4c	.576	------	------	0	None
		8 p. m	781	.730	86.9	25.5c	.553	------	------	0	None
		10 p. m	781	.618	75.6	24.8c	.459	------	------	0	None
Do	July 14	6 a. m	781	.786	74.5	23.9c	.631	------	------	0	None
		8 a. m	781	.797	78.2	25.0c	.622	------	------	0	None
		9 a. m	781	.796	81.0	27.0c	.609	------	------	0	None
		10 a. m	781	.800	84.1	------	.601	------	S.W	1	Nimbus, 1
		11 a. m	781	.799	87.2	------	.595	------	S.W	1	Nimbus, 2
		12 m	781	.810	90.5	------	.606	------	S.W	1	Nimbus, 1
		1 p. m	781	.796	91.2	------	.593	------	S.W	1	Nimbus, 2
		2 p. m	781	.792	91.6	------	.592	------	------	0	Nimbus, 2
		3 p. m	781	.781	90.2	------	.589	------	------	0	Cum. & nim., 1
		4 p. m	781	.781	93.6	------	.589	------	------	0	Cumulus, 1
		5 p. m	781	.752	87.9	------	.579	------	S.	1	None
		6 p. m	781	.741	86.9	------	.570	------	------	0	Cum. & nim., 1
		7 p. m	781	.731	83	------	.567	------	------	0	None
		8 p. m	781	.717	79.5	------	.560	------	------	0	None
		9 p. m	781	.714	77.5	------	.559	------	------	0	None

July 10.—9½ a. m., rain $1\frac{9}{10}$ in. during the day on the 10th; ceased 2¼ p. m.; cloudy rest of the day and evening.
July 11.—12 m., sultry. Showers during the evening.
July 13.—At 2.55 p. m. a breeze sprang up, accompanied by a heavy shower; rain ceased at 3.40 p. m.; quantity, $\frac{8}{10}$ in.; sky partially covered with clouds. 6 p. m., sultry. 10 p. m., evening clear and calm.
July 14.—6 a. m., clear and calm. 8 a. m., ditto. 9 a. m., ditto. 8 p. m., clear and calm. 9 p. m., ditto.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp Wilson	July 14	10 p. m.	781	29.710	77.2		29.549			0	None
		11 p. m.	781	.708	75.4		.548	29.578		0	None
Camp No. 1	July 17	Sunrise	790	29.598	71		29.501			0	Cirro-stratus, 9
		7 a. m.	790	.615	76.7		.502			0	Cirro-stratus, 9
		8 a. m.	790	.640	78.4		.513		N.E	1	Cirro-stratus, 6
		9 a. m.	790	.650	81.9		.509		N.E	1	Cirro-stratus, 6
		10 a. m.	790	.642	86.1		.490		S.	1	Cirro-stratus, 2
		11 a. m.	790	.639	86.8		.486		S.E	1	Cirro-stratus, 1
		12 m.	790	.627	87.6		.481			0	None
		1 p. m.	790	.627	87.6		.485			0	Cir.-stratus, 1
		2 p. m.	790	.617	90.5		.470		S.E	2	Nimbus, 1
		3 p. m.	790	.615	92		.469			0	None
		4 p. m.	790	.601	91.8		.464			0	None
		5 p. m.	790	.587	88.6		.463			0	Cumulus, 2
		6 p. m.	790	.582	85	86	.465			0	Cumulus, 1
		7 p. m.	790	.576	82		.465			0	Ciro-stratus, 1
		8 p. m.	790	.590	80		.481			0	None
		9 a. m.	781	.696	82		.506			0	None
		10 a. m.	781	.694	85.6		.493			0	None
		11 a. m.	781	.683	86.1		.483			0	None
		12 m.	781	.676	87		.481			0	None
		1 p. m.	781	.676	87		.485			0	None
		2 p. m.	781	.668	90		.472			0	None
		3 p. m.	781	.662	92		.466			0	None
		4 p. m.	781	.654	90.3		.471			0	None
		5 p. m.	781	.644	88		.471			0	None
		6 p. m.	781	.642	84.6		.477			0	None
		7 p. m.	781	.638	82		.477			0	None
		8 p. m.	781	.648	79.8		.490			0	None
Do	July 18	3 p. m.	790	.628	89	90	.490			0	Cirro-stratus, 4
		4 p. m.	790	.630	89.5	91	.498			0	Cirro & nim., 4
		5 p. m.	790	.614	87	88	.494			0	Cirro-cum., 2
		6 p. m.	790	.612	84	85	.498			0	Cirro-cum., 2
		7 p. m.	790	.606	82.5	83.8	.494			0	Cirro-cum. & nim., 7.
		8 p. m.	790	.640	81	83	.529	29.542		0	Cum. & nim., 8
Camp No. 2	July 19	1½ p. m.	783	29.700	91.5	92	29.506		S. W.	3	Cir. & nim., 4
		3 p. m.	783	.699	92.4	93	.509		S. W.	1	Cir. & nim., 3
		4 p. m.	783	.682	89.3	91.2	.508		S. W.	1	Cir. & nim., 3
		5 p. m.	783	.652	86.6	88	.491			0	Cirrus, 2
		6 p. m.	783	.632	84.5	86	.474			0	Cirrus, 2
		7 p. m.	783	.636	81.3	83	.484			0	Cirrus, 2
		8 p. m.	783	.642	82	84	.484			0	Cirrus, 3
Do	July 20	6 a. m.	783	.666	76.2	78	.514			0	Cumulus, 2
		7 a. m.	783	.673	80.2	81.1	.506			0	Cumulus, 1
		8 a. m.	783	.696	84	85.1	.512		N. W.	5	Cumulus, 1
		9 a. m.	783	.700	87.2	89.5	.503		N	4	Nimbus, 2
		10¼ a. m.	783	.717	91	93.5	.508		N. E.	2	Nim. & cum., 3
		11 a. m.	783	.721	89	92.2	.520		N. E.	2	Nim. & cum., 3
		12 m.	783	.722	92.6	94	.520		N. W.	4	Cumulus, 1
		1 p. m.	783	.727	91.5	93.1	.531		N. W.	2	Cumulus, 2
		2 p. m.	783	.710	91.6	93.4	.517		N. W.	2	Cumulus, 1
		3 p. m.	783	.708	90.1	92	.524		N. W.	1	Cumulus, 2
		4 p. m.	783	.694	89	90	.521		N. W.	1	Cumulus, 1
		5 p. m.	783	.689	85.8	86.9	.509			0	Cum. & nim., 1
		6 p. m.	783	.660	83	84.6	.506			0	Cum. & nim., 1

July 14.—10 p. m., slight halo around the moon. 11 p. m., ditto.

July 17.—Sunrise, calm. 7 a. m., ditto. 12 m., clear and calm. 1 p. m., calm. 3. p. m., clear and calm. 4 p. m., ditto; sultry. 8 p. m., calm and misty.

July 18.—3 p. m., calm. 4 p. m., ditto. 5 p. m., ditto. 6 p. m., ditto. 7 p. m., ditto. 8 p. m., ditto

July 22.—Slight showers at 2*h*. 4*h*. and 6*h*.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp No. 2	July 20	7 p. m	783	29.667	78.5	80.1	29.522			0	Cumulus, 1
		8 p. m	783	.672	76	79	.529			0	None
Do	July 23	8½ a. m	783	.600	78.2	79.5	.421			0	Nimbus, 9
		10 a. m	783	.597	82.6	83	.411			0	Nimbus, 9
		11 a. m	783	.586	85.5	87.2	.394			0	Nimbus, 3
		12 m	783	.592	87.5	90	.403			0	Nimbus, 3
		1 p. m	783	.582	93.6	95	.381			0	Nim. & Cir., 2
		2 p. m	783	.577	95.5	97.6	.374			0	Cumulus, 1
		3 p. m	783	.566	97	98.1	.361			0	Cum. & nim., 1
		4 p. m	783	.544	92.8	96	.362			0	Cumulus, 1
		5 p. m	783	.513	88.1	90	.347			0	Cumulus, 1
		6 p. m	783	.517	85	87	.357			0	Cumulus, 1
		7 p. m	783	.520	79.5	83	.372			0	Cir. & nim., 3
		8 p. m	783	.528	80	83.6	.376			0	Cir. & nim., 3
Do	July 24	5½ a. m	783	.517	74.9	77	.375			0	None
		7 a. m	783	.533	78.6	80.3	.371			0	None
		8 a m	783	.534	79.3	81.1	.362			0	Cir.-cum., 7
		9 a. m	783	.537	85.5	87.5	.345			0	Cir.-cum., 6
		12 m	783	.535	92	93.2	.334		S. W	1	Cr.-cu. & ni., 8
		1½ p. m	783	.521	85	86.1	.344		S. W	1	Nim. & cūm., 9
		2½ p. m	783	.520	82.6	84	.351			0	Nimbus, 9
		4 p. m	783	.474	73.6	76	.353			0	Nimbus, 10
		5½ p. m	783	.484	74.9	77	.353			0	Nimbus, 10
Do	July 25	8 a. m	783	.630	76	74	.466			0	None
		11⅓ a. m	783	.670	82	83.6	.496			0	None
		12 m	783	.664	85	87	.480		N	0.2	4
		1 p. m	783	.666	87.5	90	.481		N	0.5	2
		2 p. m	783	.652	86	88	.475		N	0.2	2
		3 p. m	783	.616	85.5	86.5	.446		N. E	1	3
		4 p. m	783	.648	80.8	82	.497		N. E	1	3
		5 p. m	783	.642	78	80	.502		N. E	1	2
		6 p. m	783	.634	75	77	.500			0	3
		7 p. m	783	.648	71	74	.522			0	9
		8 p. m	783	.600	70	73	.514			0	7
		9 p. m	783	.658	69	72	.531			0	7
Do	July 26	Sunrise	783	.698	61	63.5	.594			0	None
		6½ a. m	783	.736	64	66	.614			0	6
		7 a. m	783	.734	66.5	58.5	.604			0	6
		8 a. m	783	.716	77.8	69.8	.549			0	5
		9 7/12 a. m	783	.776	77	78	.604		S	0.1	4
		10 a. m	783	.780	77	80.5	.607		S	1	4
		11 a. m	783	.718	78.2	81.2	.545		S	1	7
		12 m	783	.752	79.5	83	.584			0	7
		1 p. m	783	.744	80	82	.577			0	7
		2 p. m	783	.750	82	83.9	.560	29.488		0	None
Camp No. 3	July 27	Sunrise	783	29.760	56.6	29.5	29.669			0	Cirrus, 2
		6 a. m	783	.802	70	66.7	.667			0	Cirrus, 2
		7 a. m	783	.811	72	69.9	.666	29.542	N. E	2	Cirrus, 1
Camp No. 4	----do----	3 p. m	783	29.746	79.6	84	29.590		E	1	Cirrus, 1
		5 p. m	783	.646	74.5	77	.511			0	Cirro-stratus, 7
		9 p. m	783	.604	69	66	.475			0	Cirro-stratus, 2
Do	July 28	Sunrise	783	.670	56.5	59	.579			0	Cumulus, 3
		9 a. m	783	.754	87		.557			0	None
		12 m	783	.704	82.8		.528			0	Cum. & nim., 4
		3 p. m	783	.674	85.5		.502			0	None
		Sunset	783	.650	75.8		.513			0	Cumulus, 3
		9 p. m	783	.667	68	73	.543			0	None
Do	July 29	Sunrise	783	.673	56.6	59	.556	29.469		0	Stratus, 2
Station 6	----do----	9 a. m	783	29.693	78.4	79.8	29.521			0	Cumulus, 1

July 24.—5½ a. m., thick mist. 7 a. m., mist partially dissipated. 4 p. m., showers with slight thunder; lightning commenced at 3 p. m.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 4 & 4 miles	July 29	12 m.	783	29.558	82.5	86	29.383		E	1	Cum. & nim.,
Camp No. 5	do	3 p. m.	783	29.581	82.8	84	29.447			0	Cum. & nim.,
		6 p. m.	783	.520	74.6	27.5	.405			0	Cum.-ni.&st., 7
		9 p m.	783	.498	70	74	.374			0	None
Do.	July 30	Sunrise	783	.688	62	64.8	.580	29.364		0	None
Station 8	do	9 a. m.	783	29.628	80.5	84	29.449		N	0.2	Cumulus 4
Station 17	do	12 m	783	29.642	84.2	85	29.462		N	0.1	Cir. & nim., 7
Camp No. 6	do	3 p. m.	783	29.667	88.5	88.6	29.527		A	0.1	Cir. & nim., 7
		6 p. m.	783	.649	79.9	81.2	.521			0	Cir. & nim., 9
		9 p m.	783	.664	72.6	75	.524			0	Nimbus, 10
Do.	July 31	Sunrise	783	.648	72.5	77	.514	29.442		0	Nimbus, 10
Station 6	do	6 a. m.	783	29.700	80.1	85.5	29.520			0	Nimbus, 10
Station 34	do	12 m	783	29.698	82	83.8	29.522		N. E.	1	Stra. & nim., 8
Camp No. 7	do	3 p. m.	783	29.676	86	87.9	29.530		N. E.	2	Stra. & nim., 9
		6 p. m.	783	.640	79.9	80.5	.512		N. E.	0.1	Stra. & nim., 8
		9 p. m.	783	.633	71.8	73	.501		S. W.	1	Cirrus, 1
Do.	Aug. 1	Sunrise	783	.654	62.5	65	.541	29.474		0	Cum.-strat., 7
Station 5	do	9 a. m.	783	29.698	90	82	29.493		S. E.	1	Cirrus, 5
Station 49	do	12 m	733	29.558	87.8	90.7	29.367		S. W.	2	Cum. & nim., 5
Station 67	do	3 p. m.	733	29.614	89.5	94.5	29.438			0	Cumulus, 3
Camp 8	do	6 p. m.	783	29.580	84.4	84	29.439			0	Cirrus, 1
		9 p. m.	783	.552	72	78	.412			0	None
Do.	Aug. 2	Sunrise	783	.630	68.5	69		29.371	S. E.	1	Nimbus, 10
Station 6	do	9 a. m.	783	29.498	78.4	79.5	29.328		S. E.	2	Cirrus, 6
Station 42	do	12 m	783	29.485	89	89	29.292		E	5	Cumulus, 5
Camp No. 9	do	3 p. m.	783	29.454	93.4	91.5	29.289		W.	6	Cum. & nim., 6
		6 p. m.	783	.416	82	84.4	.280			0	None
		9 p. m.	783	.399	75	75	.253			0	None
Do.	Aug. 3	Sunrise	783	.446	76.9	78.3	.290		S. W.	0.1	Cirrus, 1
		9 a. m.	783	.500	94.2	92	.264		W.	0.6	None
		12 m	783	.470	94.2	94	.249		W.	0.7	Cumulus, 3
Do.	Aug. 3	3 p. m.	783	.448	94	94.7	.262		W.	0.3	Cumulus, 3
		6 p. m.	783	.410	90.5	90	.253		W.	0.1	None
		9 p. m.	783	.439	83	86	.278		W.	4	None
Do.	Aug. 4	Sunrise	783	.430	77	78	.284	29.346	S. W.	1	Cirro-cum., 2
Station 45	do	9 a. m.	783	29.460	90.6	91	29.258		S. W.	4	None
Station 77	do	12 m.	783	29.420	95.1	96.3	29.211		S. W.	4	Cumulus, 3
Station 85	do	3 p. m.	783	29.352	96.7	97	29.150		S. W.	4	Cumulus, 4
Camp No. 10	do	6 p. m.	783	29.476	90.5	91.5	29.321			0	None
		9 p. m.	783	.460	79	82	.304			0	None
Do.	Aug. 5	5½ a. m.	783	.472	75.9	76	.320	29.394		0	Nimbus, 10
Station 31	do	9 a. m.	783	29.464	81	82	.284			0	Cir.-cum.&n., 8
Camp 11	do	12 m.	783	29.528	84	86	.348*			0	Nimbus, 10
		3 p. m.	783	.465	94	92	.271			0	Cum. & nim., 9
		6 p. m.	783	.420	77	78	.281		S. W.	1	Cum & nim., 3
		9 p. m.	783	.527	73.5	76.5	.390			0	Nimbus, 2
Do.	Aug. 6	Sunrise.	783	.442	72	73.1	.307	29.329		0	Cir.-cum.&n., 8
Station 4	do	9 a. m.	788	29.503	86	86	29.310		W.	2	Cumulus, 7
Station 14	do	12 m.	783	29.471	92.5	92.5	29.267		S. W.	3	Cirro.-cum., 7
Station 67	do	3 p. m.	783	29.400	94	93.9	29.206		S.	5	Cum. & nim., 8
At crossing of river	do	6 p. m.	783	29.500	88	88	29.332			0	Cum. & nim., 8
Camp 12	do	9 p. m.	783	29.522	76	76.5	29.378		S.	0.2	Nimbus, 10
Do	Aug. 7	Sunrise.	783	.489	72.5	73.9	.373	29.365		0	Cirrus, 5
Two miles from camp 12.	do	9 a. m.	783	29.508	81.6	81.5	29.325		S.	2	Cum.-strat, 6

July 30.—Sunrise, hazy.
July 31.—Rained at 6 a. m.
August 2.—Commenced raining at 4. 30 a. m.; high wind (8) at 4 a. m. ; rained from 6 to 7 o'clock—1. 25 inches.
August 3.—9 p. m., wind in gusts. *August* 4.—Sunrise, wind in gusts.
August 5.—Rain from noon to midnight—2. 5 inches.
August 6.—Rain from 7 p. m. for several hours, with thunder and lightning—1. 549 inch.
* From camp 11 to camp 21 the first table of horary corrections has been used.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Station 18 (?)	Aug. 7	12 m.	783	29.576	87.5	90	29.387			0	Cir.-cum., 6
Station 25 (?)	do	3 p. m.	783	29.436	89.5	91	39.253			0	Cum. & nim., 5
Camp 13	do	6 p. m.	783	29.486	83.5	83	29.331			0	Nimbus, 2
		9 p. m.	783	.490	75	75.5	.349			0	None
Do.	Aug. 8	Sunrise.	783	.480	69.2	71	.353	29.321		0	Cum. & nim., 6
Station 39	do	9 a. m.	783	29.440	83.8	84			S.	2	Cum.-strat., 7.
Station 78	do	12 m.	783	29.400	88.6	92			W.	1	Cum. & nim., 6
Camp 14	do	3 p. m.	783	29.366	94	96	29.174			0	Cumulus, 4
		7 p. m.	783	.422	77.8	82	.278			0	Cum.-strat., 2.
		9 p. m.	783	.338	76.5	77.5	.994			0	None
Do.	Aug. 9	Sunrise	783	.353	67.6		.232	29.180		0	Nimbus, 2
Station 40	do	9 a. m.	783	29.165	85.4		28.974		W.	0.1	None
Station 69	do	12 m.	783	29.371	90.4		29.175			0	Cumulus, 3
Station 89	do	3 p. m.	783	29.286	90.2		29.105		W.	1	Cumulus, 3
Camp 15	do	6 p. m.	783	29.358	85.5		29.200			0	None
		9 p. m.	783	.354	79.2		.213			0	None
Do.	Aug. 10	Sunrise.	783	.363	70.5		.234	29.199		0	None
Station 20	do	9 a. m.	783	29.376	76.4		29.211			0	None
Station 37	do	12 m.	783	29.390	88.8	94	29.206		W.	2	Cumulus, 3
Station 50	do	3 p. m.	783	29.306	92.3	90.5	29.120			0	None
Camp 16	do	6 p. m.	783	29.352	86	84	29.191			0	None
		9 p. m.	783	.362	76.9	79	.219			0	None
Do.	Aug. 11	Sunrise.	783	.382	71.5	73.5	.250	29.208		0	Nimbus, 10
Station 50	do	9 a. m.	783	29.358	78.4	77.6	29.188		S.	3	Nimbus, 10
Station 37	do	12 m.	783	29.466	84.2	89	29.286		S. W.	2	Cum. & nim., 8
Station 59	do	3 p. m.	783	29.368	85.4	88.4	29.200		S. W.	2	Cirrus, 2
Camp 17	do	6 p. m.	783	29.416	78.2	79.5	29.276			0	None
		9 p. m.	783	.398	70.7	75.1	.270			0	None
Do.	Aug. 12	Sunrise.	783	.310	64.9	68.9	.197			0	Cirrus, 1
		9 a. m.	783	.498	97	95	.278		W.	1	Cumulus, 3
		1z m.	783	.451	92.9	93.6	.248		S. W.	3	Cum. & nim., 4
		3 p. m.	783	.412	96.9	98.8	.212		S. W.	1	Cirro cum., 2
		6 p. m.	783	.462	83.5	85.2	.308			0	Cumulus, 1
		9 p. m.	782	.342	70.6	73.6	.215			0	Cirro-strat., 1.
Do.	Aug. 13	Sunrise.	783	.240	63.5	66.9	.130			0	None
		9 a. m.	783	.440	95.5	93.7	.225		W.	1	None
		10 a. m.	783	.441	91.3		.234		W.	2	Cumulus, 4
		11 a. m.	783	.447	93.6		.237		S. W.	0.2	Cum. & nim., 8
		12 m.	783	.429	93.5	94.6	.227		S. W.	0.5	Cumulus, 5
		1 p. m.	783	.416	94.6		.215			0	Cum. & nim., 5
		2 p. m.	783	.364	77.9		.207			0	Nimbus, 7
		3 p. m.	783	.364	90.3	93.9	.182		S. W.	0.1	Cirrus, 2
		4 p. m.	783	.356	90.2	95.6	.182		S. W.	0.1	Cirro-strat., 1.
		5 p. m.	783	.338	85.6		.181			0	None
		6 p. m.	783	.292	73.7	78	.165			0	Cirrus, 5
		7 p. m.	783	.292	70.6		.171			0	None
		8 p. m.	783	.314	68.2		.195			0	None
		9 p. m.	783	.318	66.4	69.3	.209			0	None
Do.	Aug. 14	Sunrise.	783	.321	60.6	62.6	.218	29.181		0	Cirro-strat., 3.
Station 14	do	9 a. m.	783	29.350	84.1	86.5	29.164		E.	0.3	Cirro-strat. 3.
Station 34	do	12 m.	783	29.282	88.5	91.5	29.093			0	Cumulus, 3
Station 43	do	3 p. m.	783	29.246	92.7	92.5	29.081		S.	1	Cirro-cum., 3.
Camp 18	do	6 p. m.	783	29.256	82.9	82.9	29.103			0	Cirro-strat., 2.
		9 p. m.	783	.222	72.6	73.5	.089			0	Cirrus, 4
Do.	Aug. 15	Sunrise.	783	.232	64.6	66.6	.119	29.093		0	Cirro-strat, 3.
Station 0	do	9 a. m.	783	29.286	87.5	89.9	29.092		S. W.	0.1	Cum.-strat., 3.
Station 11	do	12 m.	783	28.958	90.6	94	28.764		S.	0.3	Cumulus, 4

August 11.—Two brilliant meteors—one northwest, the other southeast—were seen about 8½ p. m.; another, at 9½ p. m. One was remarkably large, proceeding from the zenith westward through the milky way, and leaving behind it a bright trail of 10° or 15°.

August 12.—Three meteors were seen during the evening—one north in Ursæ Majoris, the other in the milky way.

August 13.—Rain commenced at 2. 20, with thunder and lightning—amount .16 inch.

OBSERVATIONS—Continued.

Station.	Date..	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 19	Aug. 15	3 p. m.	783	29.074	90.8	93.7	28.890	------	S.	0.2	Cumulus, 4
		6 p. m.	783	.081	85	83.2	.924	------	------	0	None
		9 p. m.	783	.051	74.9	76.6	.912	------	------	0	None
Do.	Aug. 16	Sunrise.	783	.060	69	70.6	.935	28.915	------	0	None
Station 10	----do----	9 a. m.	783	29.142	93.5	96	28.932	------	------	0	Cum.-strat., 4.
Station 33	----do----	12 m.	783	29.074	97.8	100.6	28.885	------	W.	0.1	Cumulus, 4
Station 49	----do----	3 p. m.	783	29.025	94.2	95.1	28.834	------	------	0	Cum. & nim., 4
Camp 20	----do----	6 p m.	783	28.978	84.3	84.3	28.824	------	------	0	Cum.-strat., 3
Do.	Aug. 17	Sunrise.	783	.926	62.5	64.5	.820	28.847	------	0	Cirro.-cum., 2
Station 4	----do----	9 a. m.	783	29.968	91.5	92.4	28.764	------	N.W.—	0.3	Cirro.-strat., 3
Station 17	----do----	12 m.	783	29.978	99.4	100.4	28.762	------	N.W.	0.3	Cirro.-strat., 3
*Camp 21	----do----	6 p. m.	783	29.008	83.9	85.4	.853	------	------	0	Cirro.-strat., 4
		9 p. m.	783	28.984	67	67.4	.865	------	------	0	None
Do.	Aug. 18	Sunrise.	783	.964	57	59.5	.874	------	------	------	------
		9 a. m.	783	29.100	93	93.6	.891	------	------	------	------
		12 m.	783	.070	97.9	103	.854	------	------	------	------
		3 p. m.	783	.062	10.7	114	.842	------	------	------	------
		6 p. m.	783	.058	100.5	96	.863	------	------	------	------
		9 p. m.	783	28.974	70	72.8	.847	------	------	------	------
Do.	Aug. 19	Sunrise.	783	.988	63.6	65	.879	------	------	------	------
		9 a. m.	783	29.074	88.7	91.3	.875	------	------	------	------
		12 m.	783	.064	96.5	98	.855	------	------	------	------
		3 p. m.	783	.038	98	99	.837	------	------	------	------
		6 p. m.	783	28.982	87.3	90.3	.821	------	------	------	------
		9 p. m.	783	.962	73.4	84	.828	------	------	------	------
Do.	Aug. 20	Sunrise.	783	.980	75.8	73.9	.838	------	------	------	------
		6 a. m.	783	.991	79	------	.835	------	------	------	------
		7 a. m.	783	.996	86	------	.817	------	------	------	------
		8 a. m.	783	29.001	87.3	------	.811	------	------	------	------
		9 a. m.	783	.012	92.1	93.1	.806	------	------	------	------
		10 a. m.	783	29.016	95.1	------	.830	------	------	------	------
		11 a. m.	783	.012	96.5	------	.794	------	------	------	------
		12 m.	783	.998	98.9	------	.786	------	------	------	------
		1 p. m.	783	.880	100.2	------	.766	------	------	------	------
		2 p. m.	783	.964	99.6	------	.755	------	------	------	------
		3 p. m.	783	.955	99.5	100.8	.751	------	------	------	------
		4 p. m.	783	.946	93.3	------	.758	------	------	------	------
		5 p. m.	783	.940	93.2	------	.764	------	------	------	------
		6 p. m.	783	.910	81.2	83.9	.763	------	------	------	------
		7 p. m.	783	.910	80.2	------	.764	------	------	------	------
		8 p. m.	783	.912	78.1	------	.767	------	------	------	------
		9 p. m.	783	29.007	77.6	79	.860	------	------	------	------
Do.	Aug. 21	Sunrise.	783	28.940	70.6	72.8	.812	------	------	------	------
		7 a. m.	783	.996	83	------	.825	------	------	------	------
		8 a. m.	783	29.004	87.9	------	.815	------	------	------	------
		9 a. m.	783	.015	90	------	.814	------	------	------	------
		10 a. m.	783	.034	93.5	------	.822	------	------	------	------
		11 a. m.	783	.016	95.6	------	.801	------	------	------	------
		12 m.	783	29.000	98.5	101.4	.785	------	------	------	------
		1 p. m.	783	28.996	100.5	------	.782	------	------	------	------
		2 p. m.	783	.976	100.5	------	.765	------	------	------	------
		3 p. m.	783	.966	101.1	101.6	.760	------	------	------	------
		4 p. m.	783	.962	96.6	------	.774	------	------	------	------
		5 p. m.	783	.950	95	------	.763	------	------	------	------
		6 p. m.	783	.932	88.2	89.9	.763	------	------	------	------
		7 p. m.	783	.978	83.9	------	.824	------	------	------	------
		8 p. m.	783	.942	80.5	------	.793	------	------	------	------
		9 p. m.	783	.936	76.8	79.2	.793	------	------	------	------
Do.	Aug. 20	Sunrise.	790	.956	73.8	------	.862	------	------	------	------
		6 a. m.	790	.963	77.1	------	.854	------	------	------	------
		7 a. m.	790	.996	86	------	.861	------	------	------	------

* The greater portion of the remarks upon the meteorological condition of the atmosphere, at stations west of Camp 21, accompany the Psychrometric and Climatological tables. (See Appendix H.)

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
Camp 21	Aug. 20	8 a. m	790	28.996	87.7		28.851				
		9 a. m	790	29.006	93		.843				
		10 a. m	790	.002	96		.827				
		11 a. m	790	28.992	97.1		.816				
		12 m	790	.976	101.5		.800				
		1 p. m	790	.958	103		.782				
		2 p. m	790	.954	103		.781				
		3 p. m	790	.942	104.2		.772				
		4 p. m	790	.923	99.9		.769				
		5 p. m	790	.898	92.3		.768				
		6 p. m	790	.894	81.6		.786				
		7 p. m	790	.896	80		.793				
		8 p. m	790	.896	78		.795				
		9 p. m	790	.892	76.9		.789				
Do	Aug. 21	Sunrise	790	.930	70.6		.844				
		6 a. m	790	.960	76.9		.852				
		7 a. m	790	.988	82.7		.861				
		8 a. m	790	.992	87.5		.845				
		9 a. m	790	29.008	90		.850				
		10 a. m	790	.008	93.8		.839				
		11 a. m	790	28.998	98.6		.819				
		12 m	790	.986	101.8		.815				
		1 p. m	790	.976	103		.800				
		2 p. m	790	.966	103		.783				
		3 p. m	790	.950	104		.781				
		4 p. m	790	.950	100.4		.795				
		5 p. m	790	.928	96		.788				
		6 p. m	790	.915	89.9		.789				
		7 p. m	790	.912	84		.798				
		8 p. m	790	.934	80.6		.826				
		9 p. m	790	.938	78.1		.834				
Do	Aug. 22	Sunrise	783	.976	70.8	73.8	.846	28.942			
Station 10	do	9 a. m	783	28.944	91	93	28.740				
Station 23	do	12 m	783	28.957	96.7	99.3	28.746				
Camp 22	do	3.45 p. m	783	28.862	97.2	98.6	28.706				
		6 p. m	783	.854	86.7	88	.710				
		9 p. m	783	.852	79.3	80.5	.696				
Do	Aug. 23	Sunrise	783	.883	69.6	71.4	.781	28.817			
Camp 23	do	12 m	783	.946	99.6	96.3	.714				
		3 p. m	783	.918	96.8	97.4	.749				
		6 p. m	783	.854	83.8	85.6	.719				
		9 p. m	783	.896	74.9	76.4	.755				
Do	Aug. 24	Sunrise	783	.946	71.6	75	.824	28.792			
Station 7	do	9 a. m	783	29.038	74	75.6	28.878				
Station 10	do	12 m	783	28.964	83.9		28.786				
Station 19	do	3 p. m	783	29.024	84.8	84.8	28.856				
Camp 24	do	6 p. m	783	29.040	77.8	78.4	28.920				
		9 p. m	783	.030	71.5	74.2	.895				
Do	Aug. 25	Sunrise	783	.054	66.6	68.8	.935	28.868			
Station 2	do	9 a. m	783	28.984	73.2	74.2	28.827				
Station 13+1600ft.	do	12 m	783	28.974	88.9	85.9	28.784				
Station 30	do	3 p. m	783	28.761	87.8	87.9	28.585				
Camp 25	do	6 p. m	783	28.756	79	79	28.632				
		9 p. m	783	.740	72.3	73.5	.604				
Do	Aug. 26	Sunrise	783	.727	68.6	69.9	.605	28.560			
Half way between stations 7 & 8	do	9 a. m	783	28.688	85.8	86.8	28.497				
Station 22	do	12 m	783	28.688	92.4	93	28.489				
Station 35	do	3 p. m	783	28.584	94	94.8	28.393				
Camp 26	do	6 p. m	783	28.716	80	80.9	28.590				
		9 p. m	783	.766	73.6	75.6	.628	28.594			
Station 4	Aug. 27	9 a. m	783	28.876	55.8	56.8	28.763				
Station 18	do	12 m	783	28.855	67.6	70	28.621				
Station 22	do	3 p. m	783	28.802	75	78.2	28.660				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction	Force.	
	1853.										
Camp 27	Aug. 27	6 p. m	783	28.884	69.2	68.3	28.786				
		9 p. m	783	.886	64	64.5	.771				
Do	Aug. 28	Sunrise	783	.846	59.5	60.7	.747	28.595			
Station 9	do	9 a. m	783	28.806	71.5	74	28.653				
Station 15	do	12 m	783	28.633	82.7	81.5	28.458				
Camp 28	do	4 p. m	783	28.520	85.6	82.1	28.495				
		6 p. m	783	.572	76	77	.456				
		9 p. m	783	.576	72.2	72.6	.440				
Do	Aug. 29	Sunrise	783	.572	66.9	68.3	.452	28.310			
Station 7	do	9 a. m	783	28.510	81.3	81.5	28.334				
Station 10	do	12 m	783	28.458	96.8	87.5	28.250				
Station bet. 18 & 19	do	3 p. m	783	28.430	86.5	86.5	28.261				
Camp 29	do	6 p. m	783	28.557	81.8	82.3	28.427				
		9 p. m	783	.474	72.6	75	.337				
Do	Aug. 30	Sunrise	783	.464	68.9	70.7	.342	28.266			
Station 2	do	9 a. m	783	28.480	89.2	87	28.284				
Station bet. 7 & 8	do	12 m	783	28.426	91.9	91.1	28.231				
Station 15	do	3 p. m	783	28.410	91.6	93.7	28.228				
Camp 30	do	6 p. m	783	28.412	81.5	82.3	28.282				
		9 p. m	783	.411	74	76	.270				
Do	Aug. 31	Sunrise	783	.362	66.4	68.1	.245	28.291			
Station betw. 4 & 5	do	9 a. m	783	28.400	89	88.5	28.204				
		12 m	783	.578	92.3	96.4					
Station 11	do	4 p. m	783	28.414	94.6	94.5	28.233				
Camp 31	do	6 p. m	783	28.485	88.4	87	28.340				
		9 p. m	783	.468	74	75	.342				
Do	Sept. 1	Sunrise	783	.467	64.9	67.9	.359	28.389			
Station 3	do	9 a. m	783	28.460	89.6	92.5	28.263				
Station 9	do	12 m	783	28.376	96.5	99.5	28.170				
Station 15	do	3 p. m	783	28.276	101.5	96.5	28.070				
Camp 32	do	6 p. m	783	28.303	90	85.1	28.155				
		9 p. m	783	.261	74.5	73	.122				
Do	Sept. 2	Sunrise	783	.286	66.8	68.5	.171	28.200			
Station 8	do	9 a. m	783	28.349	92.7	92.9	28.121				
Station 16	do	12 m	783	28.366	94.6	96	28.150				
Station 19	do	3 p. m	783	28.328	98.7	97	28.156				
Camp 33	do	9 p. m	783	28.338	75	74	28.197				
Do	Sept. 3	Sunrise	783	.302	55.5	65.5	.215	28.244			
Station 3	do	9 a. m	783	28.206	90	89.5	27.989				
Station 14	do	12 m	783	28.201	95	95	27.986				
Station 23	do	3 p. m	783	27.920	98	95.5	27.753				
Camp 34	do	6 p. m	783	27.904	86.5	85.7	27.763				
		9 p. m	783	.912	77.5	77	.765				
Do	Sept. 4	Sunrise	783	.866	64.7	65.5	.758	27.827			
Station 5	do	9 a. m	783	28.004	89.9	90.5	27.787				
Station 11	do	12 m	783	27.960	96	95.5	27.743				
Camp 35	do	3 p. m	783	27.774	92.4	94	27.623				
		6 p. m	783	.770	78.5	79	.653				
		9 p. m	783	.788	72	72.9	.656				
Do	Sept. 5	Sunrise	783	.770	58.2	59	.676				
		9 a. m	783	.872	85.8	89.3	.662				
		12 m	783	.896	101.8	99.5	.680				
		3 p. m	783	.876	98.8	94.6	.709				
		6 p. m	783	.848	81.8	83.4	.723				
		9 p. m	783	.908	72.5	73.5	.775				
Do	Sept. 6	Sunrise	783	28.012	63	65	27.906	27.799			
Station 1 + ½ mile	do	9 a. m	783	28.109	67.4	69	27.948				
Station 5 + 1 mile	do	12 m	783	27.804	73.6	74.6	27.643				
Station 21	do	3 p. m	783	27.884	77.6	80	27.768				
Camp 36	do	6 p. m	783	27.866	76.2	78.2	27.753				
		9 p. m	783	.898	64	64.5	.786				
Do	Sept. 7	Sunrise	783	.896	53.4	54.3	.814	27.810			
Station betw. 3 & 4	do	9 a. m	783	27.998	70	70.5	27.830				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Station 11	Sept. 7	12 m.	783	27.846	79.5	79.2	27.670				
Station 23	----do----	3 p. m	783	27.766	83.2	81.8	27.636				
Camp 37	----do----	6 p. m	783	27.816	74.5	72.8	27.708				
		9 p. m	783	.780	61	61	.676				
Do	Sept. 8	Sunrise	783	.796	55.9	57	.708	27.664			
Station 4	----do----	9 a. m	783	27.752	70.8	73.1	27.582				
Station 16	----do----	12 m	783	27.791	83.4	82.6	27.605				
Station 30	----do----	3 p m	783	27.746	84	81.5	27.613				
Camp 38	----do----	6 p. m	783	27.662	75.2	75.6	27.553				
		9 p m	783	.672	64	65.7	.560				
Do	Sept. 9	Sunrise	783	27.746	56.5	57	27.657	27.537			
Station 4	----do----	9 a. m	783	27.822	76	75.5	27.639				
Station 16	----do----	12 m	783	27.770	80	79.3	27.592				
Camp 39	----do----	3 p. m	783	27.688	84.2		27.557				
		6 p. m	783	.671	78.9	75.7	.553				
		9 p. m	783	.690	66.8	68	.572				
Do	Sept. 10	Sunrise	783	.666	56.9	58.2	.575	27.498			
Station betw. 3 & 4	----do----	10 a. m	783	27.766	79	76	27.566				
Station 13	----do----	12 m	783	27.690	83.5	87.2	27.404				
Station 27	----do----	3 p. m	783	27.577	86.8	89	27.440				
Camp 40	----do----	6 p. m	783	27.540	81.2	80.6	27.416				
		9 p. m	783	.552	73.8	75	.415				
Do	Sept. 11	Sunrise	783	.506	56.4	58.1	.418	27.334			
Station 3	----do----	9 a. m	783	27.540	78.2	81.5	27.354				
Station 12	----do----	12 m	783	27.469	91.2	91.2	27.267				
Station 28	----do----	3 p. m	783	27.396	92.5	92.9	27.246				
Camp 41	----do----	6.40 p. m	783	27.340	82.5	82.5					
		9 p. m	783	.362	76.5	76.7	.222				
Do	Sept. 12	Sunrise	783	.348	60.3	61.2	.251	27.178			
Station 2	----do----	9 a. m	783	27.412	77	77	27.229				
Station 10	----do----	12 m	783	27.346	90.8	90.9	27.145				
Station 19	----do----	3 p. m	783	26.968	88.5	88.7	26.830				
		6 p. m	783	27.012	85.8	84	.875				
Camp 42	----do----	9 p. m	783	26.960	72.6	73	26.831				
Do	Sept. 13	Sunrise	783	.894	63.1	64	.791				
		9 a. m	783	.939	80.8	81	.750				
		12 m	783	.910	89	89.3	.716				
		3 p. m	783	.844	86.5	88 7	.710				
		6 p. m	783	.843	83.5	84.6	.716				
		9 p. m	783	.850	70.5	71.8	.727				
Do	Sept. 14	Sunrise	783	.838	53.7	54.9	.750	26.863			
Station bet. 10 & 11	----do----	12 m	783	26.562	89	91.7					
Sta. near camp 43	----do----	3 p. m	783	26.748	92.7	93.7	26.601				
Camp 43	----do----	6 p. m	783	26.727	84.5	84.3	26.599				
		9 p. m	783	.722	78.3	80	.580				
Do	Sept. 15	Sunrise	783	.784	54.5	56.9	.603	26.779			
Station betw. 3 & 4	----do----	9 a. m	783	26.715	91.6	92.5	26.537				
Station 13	----do----	12 m	783	26.596	76	82.9	26.398				
Station 22	----do----	3 p. m	783	26.516	94.7	96.7	26.365				
Camp 44	----do----	6 p. m	783	26.585	86.4	86.1	26.454				
		9 p. m	783	.578	72.5	74	.474				
Do	Sept. 16	Sunrise	783	.558	66.2	67.9	.449	26.656			
Station betw. 8 & 9	----do----	9 a. m	783	26.448	84	87.7	26.253				
Sta betw. 14 & 15	----do----	12 m	783	26.338	90	89	26.146				
Station 20	----do----	3 p. m	783	26.178	94.7	92.5	26.030				
Camp 45	----do----	6 p. m	783	26.151	80.5	80.2	26.037				
		9 p. m	783	.176	73.5	74.5	.048				
Do	Sept. 17	Sunrise	783	.230	61.5	61.5	.134	26.289			
Station 12	----do----	9 a. m	783	26.202	75.9	76.4	26.028				
Station 15	----do----	12 m	783	26.010	82.8	83.9	25.835				
		3 p m	783	25.896	87.7	89					
Station 25	----do----	6 p. m	783	25.812	82	81.2	25.689				
Camp 46	----do----	9.30 p. m	783	25.944	75	75.5	25.812				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 46	Sept. 18	Sunrise	783	25.958	56.5	56.8	25.874				
		9 a. m	783	26.140	67.7	69.5	.988				
		12 m	783	.168	75.2	76.4	26.011				
		3 p. m	783	.151	77.9	80.6	.072				
		6 p. m	783	.119	68.5	69.5	.044				
		9 p. m	783	.150	59.5	60.7	.050				
Do	Sept. 19	Sunrise	783	.241	54.6	55.6	.161	26.136			
Station 5	do	9 a. m	783	26.298	67.5	68.7	26.144				
Station 14	do	12 m	783	26.898	75.6	75.7	26.738				
Station 21	do	3 p. m	783	26.308	79.5	82.1	26.194				
Camp 47	do	6 p. m	783	26.268	75	73.5	26.165				
		9 p. m	783	.280	65.5	68	.170				
Do	Sept. 20	Sunrise	783	26.380	56	57.5	26.294	26.125			
Station 5	do	12 m	783	26.378	68.5	70.5	26.236				
Station 9	do	3 p. m	783	26.250	68.5	69.5	26.163				
Station 16	do	6 p. m	783	26.206	62.7	62.3	26.126				
Camp 48	do	9 p. m	783	26.180	61.1	62	26.080				
Do	Sept. 21	Sunrise	783	.198	50	51.4	.128				
Station 2	do	9 a. m	783	26.319	65.9	65.9	26.167				
Station 10	do	12 m	783	26.169	73.5	74	26.016				
Station 18	do	4 p. m	783	26.157	74.7	75.5	26.070				
Camp 49	do	6 p. m	783	26.119	70.1	65.7	26.028				
		9 p. m	783	.086	55	56.5	.000				
Do	Sept. 22	Sunrise	783	.080	53.5	54.3	.003	25.795			
Sta. 3 + 1195 rev	do	9 a. m	783	25.993	70.1	73	25.833				
Station 7	do	12 m	783	25.899	80.3	81.8	25.731				
Station 16	do	3 p. m	783	25.825	82.3	83.1	25.707				
Camp 50	do	6 p. m	783	25.780	73	74.3	25.684				
		9 p. m	783	.796	69.5	70.8	.676				
Do	Sept. 23	Sunrise	783	.766	53.6	52	.689	25.526			
Station 6	do	9 a. m	783	25.614	72.2	72.5	25.441				
Station 16	do	12 m	783	25.616	83	82.2	25.436				
Station 18	do	3 30 p. m	783	25.429	80.3	80.9	25.328				
Camp 51	do	6 p. m	783	25.435	70.7	69.3	25.350				
		9 p. m	783	.422	57.1	57.2	.336				
Do	Sept. 24	Sunrise	783	.442	46.3	47	.382	25.255			
Station 5	do	9 a. m	783	25.370	69.1	70	25.205				
Station 14	do	12 m	783	25.415	76	76.6	25.251				
Camp 52	do	3 p. m	783	25.394	80.5	79.5	25.293				
		6 p. m	783	.360	70.8	71.9	.276				
		9 p. m	783	.352	55.9	56.2	.262				
Do	Sept. 25	Sunrise	783	.345	41.2	42.1	.282				
		9 a. m	783	.391	70.3	66.8	.222				
		12 m	783	.364	74.7	76.1	.205				
		3 p. m	783	.316	77.7	79	.223				
		6 p. m	783	.296	68.8	69.5	.218				
		9 p. m	783	.324	57.5	58.2	.240	25.117			
Station 2	Sept. 26	Sunrise	783	25.268	46.3	47.5	25.195				
Station 8	do	9 a. m	783	24.963	72	65	24.792				
Station 17	do	12 m	783	25.048	75.5	73.9	24.887				
Camp 53	do	3.30 p. m	783	24.957	77.7	79	24.871				
		6 p. m	783	.978	71.2	69	.895				
		9 p. m	783	25.014	64.3	64.5	.906				
Do	Sept. 27	Sunrise	783	.006	59	59	.904	24.753			
Station 5	do	9 a. m	783	24.981	65	66	24.825				
Camp 54	do	12 m	783	25.070	76.5	76.3	24.907				
		3 p. m	783	.036	75.5	77.6	.947				
		6 p. m	783	.032	64.3	63.3	.965				
		9 p. m	783	.050	63.5	61.9	.953				
Do	Sept. 28	Sunrise	783	25.030	55.7	57	.937				
	do	9 a. m	783	.047	63.2	66.1	.896				
	do	12 m	783	24.984	61	63	.855				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 54	Sept. 28	3 p. m.	783	24.953	65	65.3	24.887				
		6 p. m.	783	.958	59.5	62	.909				
		9 p. m.	783	.916	56.5	58.5	.836				
Do	Sept. 29	Sunrise	783	.932	49.5	50.5	.852	24.813			
Station 2	do	9 a. m.	783	24.912	65.7	64.7	24.754				
Station 12	do	12 m.	783	24.476	72	71.3	24.329				
Station 24	do	3 p. m.	783	24.020	70.5	71.9	23.946				
Camp 55	do	9 p. m.	783	24.006	58	57.5	23.924				
Do	Sept. 30	Sunrise	783	.044	50.6	51.5	.963	23.938			
Station 4	do	9 a. m.	783	23.978	54.7	51.8	23.847				
Station 11	do	12 m.	783	23.958	56.9	56.5	23.841				
Camp 56	do	3 p. m.	783	23.526	53.5	54.5	23.489				
		6 p. m.	783	.542	49.5	49.5	.509				
		8 p. m.	783	.552	45	47.3	.503				
Do	Oct. 1	Sunrise	783	.614	41.5	42	.552				
		9 a. m.	783	.697	45.7	47		23.482			
Sta. 2 + 299 rev.	do	12 m.	783	23.964	53.7	56.5	23.853				
Station 4	do	3 p. m.	783	23.987	55.5	57.8	23.945				
Camp 57	do	6 p. m.	783	24.017	50.5	51	23.982				
		9 p. m.	783	.022	42.1	42	.973				
Do	Oct. 2	Sunrise	783	.018	32.5	29.5	.976	23.910			
Camp 57 + 890 rev.	do	9 a. m.	783	23.975	53.4	57.5	23.848				
Station 7	do	12 m.	783	23.749	62.3	64	23.621				
Station 15	do	3 p. m.	783	23.716	65.5	69	23.654				
Camp 58	do	6 p. m.	783	23.918	58.5	59.7	23.866				
		9 p. m.	783	.888	44.7	46.3	.834				
Do	Oct. 3	Sunrise	783	.872	32.3	32	.828	23.743			
Station 3	do	9 a. m.	783	24.296	55.3	58.5	24.214				
Station 11	do	12 m.	783	24.868	66	71	24.728				
Station 17	do	3 p. m.	783	25.354	73.7	78.7	25.268				
Camp 59	do	6 p. m.	783	25.320	73.5	71.5					
Albuquerque	do	9 p. m.	783	25.288	53.7	54.8	25.207				
Do	Oct. 4	Sunrise	783	.313	39.3	39.7	.255				
		7 a. m.	783	.364	46		.261				
		8 a. m.	783	.376	52		.254				
		9 a. m.	783	.392	67.7	72.3	.229				
		10 a. m.	783	.376	70	75.5	.202				
		11 a. m.	783	.398	80.1	76.9	.188				
		12 m.	783	.399	89.5	84.7	.204				
		1 p. m.	783	.384	86.9	84.3	.239				
		2 p. m.	783	.335	78.1	84.5	.219				
		3 p. m.	783	.335	82.5	87.5	.229				
		4 p. m.	783	.314	81	84	.222				
		5 p. m.	783	.294	76.5	82	.208				
		6 p. m.	783	.282	69.5	72	.202				
		7 p. m.	783	.272	62.3	63	.198				
		8 p. m.	783	.270	56.5	57.1	.194				
		9 p. m.	783	.260	53.7	54.4	.184				
Do	Oct. 5	Sunrise	783	.254	40.3	41	.194				
		7 a. m.	783	.348	58.7	57.1	.214				
		8 a. m.	783	.364	64.3		.214				
		9 a. m.	783	.364	63.1	64.8	.211				
		10 a. m.	783	.381	70.8	74.5	.203				
		11 a. m.	783	.369	72.3	74	.176				
		12 m.	783	.364	86	83.4	.177				
		1 p. m.	783	.350	92	93.2	.191				
		2 p. m.	783	.334	89	92.5	.203				
		3 p. m.	783	.332	85		.210				
		4 p. m.	783	.322	82.5	87	.226				
		5 p. m.	783	.286	72.3	73.5	.208				
		6 p. m.	783	.274	65.6	67.5	.202				
		7 p. m.	783	.266	61	62	.193				
		8 p. m.	783	.274	56.5	59.5	.197				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Albuquerque	Oct. 5	9 p. m.	783	25.286	63	64.1	25.189				
Do	Oct. 6	6 a. m.	783	.262	40	40	.202				
		7 a. m.	783	.294	46.5	47.3	.190				
		8 a. m.	783	.308	54.3	56	.181				
		9 a. m.	783	.334	67.5	73.1	.172				
		10 a. m.	783	.308	69.5	77.8	.135				
		11 a. m.	783	.302	72.7	82.3	.108				
		12 m.	783	.299	81.5	81.5	.124				
		1 p. m.	783	.274	76	78.1	.152				
		2 p. m.	783	.250	77.9	82.8	.144				
		3 p. m.	783	.238	79.3	84	.140				
		4 p. m.	783	.210	75	80	.131				
		5 p. m.	783	.192	70.8	75	.119				
		6 p. m.	783	.201	64	65.6	.132				
		7 p. m.	783	.210	59.9	61.1	.142				
		8 p m.	783	.172	58.5	52.8	.092				
		9 p. m.	783	.184	48.1	50	.121				
Do	Oct. 7	6 a. m.	783	.208	39.5	37.5	.150				
		7 a. m.	783	.275	58.7	61	.142				
		8 a. m.	783	.286	61.5	66	.142				
		9 a. m.	783	.300	67	72	.139				
		10 a. m.	783	.304	68.7	70.7	.132				
		11 a. m.	783	.302	72	80	.110				
		12 m.	783	.294	90	86	.099				
		1 p. m.	783	.248	81.7	87	.114				
		2 p. m.	783	.242	87.5	82.5	.115				
		3 p. m.	783	.250	94	100.6	.119				
		4 p. m.	783	.234	89.5	92.3	.123				
		5 p. m.	783	.216	74	79.5	.134				
		5½ p. m.	783	.182	64.9	67	.116				
		7 p. m.	783	.172	57.8	58.3	.107				
		8 p. m.	783	.180?			.101				
		9 p. m.	783	.180	54	54.5	.104				
Do	Oct. 8	6 a. m.	783	.170	34	34.5	.124				
		7 a. m.	783	.230	62	52.7	.101				
		8 a. m.	783	.266	59	63	.128				
		9 a. m.	783	.280	62.5	70.5	.129				
		9 a. m.	785	.332	76.5		.162				
		10 a. m.	783	.290	72	72	.111				
		11 a m.	783	.260	70.6	74.5	.060				
		12 m.	783	.242	76	79	.079				
		12 m.	785	.276	77.9	79	.120				
		1 p. m.	783	.227	87.5	80	.088				
		2 p. m.	783	.220	90	83.4	.088				
		3 p. m.	783	.196	80.7	83.5	.104				
		3 p. m.	785	.209	80.2		.129				
		4 p. m.	783	.177	80.5	81	.094				
		5 p. m.	783	.186	80.8	80.8	.095				
		6 p. m.	783	.054	74.3	72	.092				
		6 p. m.	785	.166	71		.113				
		7 p. m.	783	.140	58.3	57.5	.090				
		8 p. m.	783	.142	58		.082				
		9 p. m.	783	.138	51.8	51.7	.066				
		9 p. m.	785	.150	51	51.7	.093				
Do	Oct. 9	6 a. m.	785	.156	34.8	35	.113				
		6 a. m.	783	.138	34.6	35	.090				
		7 a. m.	783	.166	51.2		.052				
		8 a. m.	783	.192	59.5		.053				
		9 a. m.	785	.236	76.5	68.9	.068				
		10 a. m.	783	.198	70.9		.021				
		11 a. m.	783	.180	73.5	74	24.986				
		1 p. m.	783	.157	80.5	80.5	25.026				
		2 p. m.	783	.144	80.5	80.2	.035				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First Reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Albuquerque	Oct. 9	3 p. m.	783	25.679	83	79.5	24.974				
		3 p. m.	785	.102	80.5		25.014				
		4 p m.	783	(?)			24.996				
		5 p. m.	783	(?)			25.021				
		6 p. m.	783	.102	72.4	72.9	.016				
		6 p. m.	785	.118	70.7		.046				
		7 p. m.	783	.078	56.5	56.5	.018				
		8 p. m.	783	.054	53.6	54	24.986				
		9 p. m.	783	.070	51.8	51.7	.996				
		9 p. m.	785	.074	51.8		25.014				
Do	Oct. 10	6 a. m.	785	.198	44	44	.140				
		6 a. m.	783	.098	41.5		.036				
		7 a. m.	783	.182	76.5	62.9	.012				
		9 a. m.	783	.178	66.8	71.2	.018				
		9 a. m.	785	.230	68.3	71.2	.140				
		12 m.	785	.199	85.2	86.6	.032				
		3 p. m.	785	.149	86.1	86.6	.049				
		6 p. m.	785	.115	66.9	69.3	.052				
		9 p. m.	785	.115	58	48	.042				
Do	Oct. 11	6 a. m.	785	.148	44	43	.091				
		9 a. m.	785	.288	66.3	69.2	.141				
		12 m.	785	.275	75.3	78.5	.125				
		3 p. m.	785	.244	76.8	80	.163				
		6 p. m.	785	.204	64.9	65	.145				
		9 p. m.	785	.186	52.3	53	.125				
Do	Oct. 12	6 a. m.	785	.192	43	43.1	.138				
		9 a. m.	785	.254	62.2	65	.116				
		12 m.	785	.248	81.5	84	.085				
		3 p. m.	785	.194	87	88.1	.091				
		6 p. m.	785	.144	70	71.8	.084				
		9 p. m.	785	.160	63.7	66.7	.075				
Do	Oct. 13	6 a. m.	785	.149	54	54.5	.070				
		9 a. m.	785	.207	76.8	83.5	.037				
		12 m.	785	.204	84.5	88.9	.034				
		3 p. m.	785	.090	76.2	79.1	.012				
		6 p. m.	785	.110	67.7	69	.045				
		9 p. m.	785	.133	62.7	62.9	.049				
Do	Oct. 14	6 a. m.	785	.179	50	50	.109				
		9 a. m.	785	.192	68.8	70.9	.040				
		12 m.	785	.280	65.8	66.5	.152				
		6 p. m.	785	.237	59.5	59.9	.190				
		9 p. m.	785	.325	56.7	57	.253				
Do	Oct. 15	6 a. m.	785	.290	52	52.8	.214				
		9 a. m.	785	.358	60	59.3	.224				
		12 m.	785	.236	79.2	83	.078				
		3 p. m.	785	.269	66	68.5	.212				
		6 p. m.	785	.238	58.5	59.5	.194				
		9 p. m.	785	.274	61.2	62.5	.193				
Do	Oct. 16	6 a. m.	785	.282	52.9	53.7	.204				
		9 a. m.	785	.300	57	57.5	.173				
		12 m.	785	.314	60.2	61.5	.198				
		3 p. m.	785	.291	60.1	63	.248				
		6 p. m.	785	.280	57	58	.238				
		9 p. m.	785	.282	48.7	51.5	.228				
Do	Oct. 17	6 a. m.	785	.308	48.5	49.3	.241				
		9 a. m.	785	.396	57	58.7	.269				
		12 m.	785	.404	77.1	78.6	.250				
		3 p. m.	785	.336	70	75.2	.269				
		6 p. m.	785	.307	65	68	.247				
		9 p. m.	785	.318	57.5	58.3	.246				
Do	Oct. 18	9 a. m.	785	.362	65.5	65.6	.257				
		12 m.	785	.298	73.9	79.2	.151				
		3 p. m.	785	.299	77	81.5	.218				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Albuquerque	Oct. 18	9 p. m.	785	25.232	65	69.5	25.215				
Do	Oct. 19	9 a. m.	785	.310	76	75.2	.181				
		12 m.	785	.314	77.1	79.9	.160				
		3 p. m.	785	.277	82.8	86.5	.183				
		9 p. m.	785	.198	51.6	52.9	.140				
Do	Oct. 20	9 a. m.	785	.290	70.7	71.5	.172				
		12 m.	785	.268	77.5	80.5	.114				
		3 p. m.	785	.180	77.6	78	.098				
		9 p. m.	785	.124	61	60.5	.044				
Do	Oct. 21	6 a. m.	785	.130	45	45.5	.071				
		9 a. m.	785	.222	64.5	65.5	.079				
		12 m.	785	.200	78.5	82	.044				
		3 p. m.	785	.096	80	83.5	.009				
		9 p. m.	785	.054	51	47.1	24.997				
Do	Oct. 22	6 a. m.	785	24.978	38	37.3	.993				
		9 a. m.	785	25.032	57.2	60.5	.906				
		12 m.	785	24.980	69.5	71.4	.846				
		3 p. m.	785	.961	62.5	66	.914				
		9 p. m.	785	25.075	36.1	38.2	25.051				
Do	Oct. 23	9 a. m.	785	.204	43	44	.150				
		12 m.	785	.214	70.5	61	.075				
		3 p. m.	785	.216	71	72	.148				
		9 p. m.	785	.198	34.5	34	.178				
Do	Oct. 24	6 a. m.	785	.244	25	25	.214				
		9 a. m.	785	.311	60.5	63.3	.177				
		12 m.	785	.247	62.5	62	.137				
		3 p. m.	785	.122	69.5	70.8	.058				
		6 p. m.	785	.036	50	50	.011				
		9 p. m.	785	24.974	40	44	24.941				
Do	Oct. 25	6 a. m.	785	.978	43	42	.924				
		9 a. m.	785	.874	57.7	57.8	.746				
Do	Oct. 26	6 a. m.	785	25.016	31.5	29.5	.987				
		9 a. m.	785	.121	55.5	53.5	.999				
		12 m.	785	.142	69.5	70.5	25.006				
		3 p. m.	785	.105	67.7	68	.045				
		6 p. m.	785	.052	49	49	.030				
		9 p. m.	785	.044	32	34.5	.029				
Do	Oct. 27	6 a. m.	785	.123	27.5	27	.103				
		9 a. m.	785	.196	62.3	63.5	.059				
		12 m.	785	.216	80	79.1	.156				
		3 p. m.	785	.168	70	70.3	.102				
		6 p. m.	785	.156	50.6	51.6	.129				
Do	Oct. 28	6 a. m.	785	.233	33.5	33.5	.200				
		9 a. m.	785	.328	73.5	74.5	.165				
		12 m.	785	.442	72.5	75.4	.298				
		3 p. m.	785	.446	73.8	74	.370				
		6 p. m.	785	.410	57.5	58.2	.367				
Do	Oct. 29	6 a. m.	785	.469	34	33	.435				
		9 a. m.	785	.528	61	58	.392				
		12 m.	785	.584	72.3	78.2	.430				
		3 p. m.	785	.546	82.9	81.5	.452				
		6 p. m.	785	.488	62	62	.435				
Do	Oct. 30	9 a. m.	785	.496	62.5	59.5	.357				
		12 m.	785	.478	85	84.5	.303				
		3 p. m.	785	.481	72.7	74.5	.409				
		9 p. m.	785	.452	35.5	35.5	.429				
Do	Oct. 31	9 a. m.	785	.126	61.7	61.2	24.989				
		12 m.	785	.174	73.1	75.4	25.030				
		3 p. m.	785	.106	71.5	70.5	.038				
		6 p. m.	785	.039	61.5	63.5	24.988				
		9 p. m.	785	24.994	40.8	42	.959				
Do	Nov. 1	6 a. m.	785	25.020	41.2	42.5	.970				
		9 a. m.	785	.053	61.5	61.7	.917				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Albuquerque	Nov. 1	12 m	785	25.068	79.5	82.4	24.910				
		3 p. m	785	24.994	79.5	80.3	.908				
		6 p. m	785	.970	66	66.2	.909				
		9 p. m	785	.978	41	43	.943				
Do	Nov. 2	6 a. m	785	25.112	28	27.5	25.091				
		9 a. m	785	.250	58	58.9	.122				
		12 m	785	.278	73.6	75.5	.131				
		3 p. m	785	.258	70.5	71.2	.191				
		6 p. m	785	.236	55	55.2	.200				
		9 p. m	785	.216	37.5	29.5	.179				
Do	Nov. 3	6 a. m	785	.342	29	28	.321				
		9 a. m	785	.361	50	49.7	.250				
		12 m	785	.364	78.5	81.5	.206				
		3 p. m	785	.308	72.5	70.2	.237				
		6 p. m	785	.282	64	63.5	.225				
		9 p. m	785	.232	37	39	.206				
Do	Nov. 4	9 a. m	785	.378	64.5	64.5	.235				
		12 m	785	.359	73.2	75	.214				
		3 p. m	785	.310	70.6	77.2	.242				
		9 p. m	785	.226	35	36.5	.204				
Do	Nov. 5	9 a. m	785	.404	55.6	58	.282				
		12 m	785	.338	66.5	70.5	.208				
		3 p. m	785	.279	77.5	80	.197				
Do	Nov. 6	12 m	785	.210	65.7	68.2	.083				
		3 p. m	785	.154	68.3	70.2	.093				
		9 p. m	785	.100	50	51	.045				
Do	Nov. 7	6 a. m	785	.082	37	37	.041				
		9 a. m	785	.094	53	54.5	24.977				
		12 m	785	.094	57		.986				
Do	Nov. 8	6 a. m	785	.288	36	38	25.249				
		9 a. m	785	.364	50	51.4	.253	25.127			
Camp 61, Isleta*	Nov. 9	9 p. m	785	25.348	39.9	37.5	25.315				
Do	Nov. 10	Sunrise	785	.202	24	25	.175				
		9 a. m	785	.255	54	72	.136	25.106			
Station —	----do----	12 m	785	25.109	60.7	64.5	24.992				
Station H	----do----	3 p. m	785	24.665	69	65.5	24.604				
Station + ½ mile	----do----	Sunset	785	24.574	61.5	58.5	24.524				
Camp 62†	Nov. 11	Sunrise	785	24.824	22.5	23	24.802				
		9 a. m	785	.924	51	50	.812	24.882			
Station 6	----do----	1 p. m	785	24.479	63.5	64.5	24.399				
Station bet. 16 & 17	----do----	4 p. m	785	24.500	66.3	67.5	24.456				
Station bet. 18 & 19	----do----	Sunset	785	24.457	62.5	61.5	24.406				
Camp 63	----do----	9 p. m	785	24.512	46.8	46.9	24.467				
Do	Nov. 12	Sunrise	785	.657	34.5	33	.608				
		9 a. m	785	.734	46.5		.634				
		12 m	785	.746	68.7	75	.616				
		3 p. m	785	.708	73.7	80.2	.633				
		6 p. m	785	.670	58.5	58.5	.628				
		9 p. m	785	.614	34.5	34.6	.595				
Do	Nov. 13	Sunrise	785	.586	28.7	28.5	.550				
		9 a. m	785	.660	49.2	52	.553				
		12 m	785	.650	73	84	.509				
		3 p. m	785	.588	73.8		.519				
		5 p. m	785	.543	63	63.7	.500				
		9 p. m	785	.522	41.8	42.7	.488				
Do	Nov. 14	Sunrise	785	.476	29	29	.438	24.591			
Station bet. 10 & 11	----do----	9 a. m	785	24.330	50	51	24.221				
Station E	----do----	12 m	785	24.228	65.3	65	24.106				
Camp 64	----do----	3 p. m	785	24.068	67.5	67.1	24.013				

* The altitude of Isleta is deduced from corresponding observations at Albuquerque.

† The altitude of Camp 62 is deduced from corresponding observations at station 1, near Camp 61′, in valley of Rio Grande.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 64	Nov. 14	Sunset	785	24.056	62.7	61.8	24.040				
		9 p. m	785	.051	49.3	49	.028				
Do	Nov. 15	Sunrise	785	.030	26	27	23.983	24.301			
Station 3	do	9 a. m	785	24.052	51	50.5	23.942				
Station bet. 13 & 14	do	1 p. m	785	24.030	64.5	64.5	23.953				
Camp 65	do	3 p. m	785	23.956	65.5	64	.906				
		9 p. m	785	.900	35.7	37.8	.879				
Do	Nov. 16	Sunrise	785	.882	25	25	.838	24.071			
Station 6	do	9 a. m	785	23.799	44.5	49.7	23.704				
Sta. I, bet. 13 & 14	do	12 m	785	23.688	59.5	61.3	23.579				
Camp 66	do	3 p. m	785	23.208	62.7	60.7	23.165				
		6 p. m	785	.180	51.3	51.5	.162				
		9 p. m	785	.170	27.6	28	22.968	23.281			
Station 3	Nov. 17	Sunrise	785	22.988	35	29	22.953				
Station bet. 14 & 15	do	9.30 a. m	785	22.719	49	51	22.612				
Camp 67	do	12 m	785	22.660	51.3	51	22.571				
		3 p. m	785	.582	51.6	52.3	.565				
		Sunset	785	.591	46.7	47.1	.589				
		9 p. m	785	.594	29.5	31	.592				
Do	Nov. 18	Sunrise	785	.580	17.5		.551	22.682			
Station 3	do	9 a. m	785	22.512	29	29.8	22.449				
Station 16	do	12 m	785	22.632	48	47.3	22.549				
Station 27	do	3 p. m	785	22.914	49.8	49.5	22.899				
Station bet. 31 & 32	do	6 p. m	785	23.082	47.5	45	23.066				
Camp 68	do	9 p. m	785	23.075	36.2	36	23.052				
Do	Nov. 19	Sunrise	785	.057	24	24	.014	23.073			
Station P	do	9.30 a. m	785	23.170	40.2	40	23.081				
Station 6	do	12 m	785	23.253	47.5	48.5	23.171				
Camp 69	do	3 p. m	785	23.534	58.3	54.6	23.500				
		Sunset	785	.526	48.7	47.7	.518				
		9 p. m	785	.556	28	25.5	.550				
Do	Nov. 20	Sunrise	785	.601	9.7		.590				
		9 a. m	785	.693	35.5	37.2	.617	23.610			
Station 4	do	12 m	785	23.908	49.8	57.5	23.818				
Camp 70, Zuñi river	do	3 p. m	785	24.032	59.5	61.5	23.995				
		5 p. m	785	.005	53.5	52.7	.985				
		9 p. m	785	.014	29.3	28	24.006				
Do	Nov. 21	7 a. m	785	.024	20.5		23.990				
		9 a. m	785	.100	36.5	38	24.022				
		12 m	785	.110	64.5	68	23.990				
		3.30 p. m	785	.074	65.5	66.5	.938				
		5 p. m	785	.058	57.7	56.3	.938				
		9 p. m	785	.018	32.6	32.7	24.001				
Do	Nov. 22	7 a. m	785	.020	22		23.982				
		9 a. m	785	.028	35.5	36	.961				
		12 m	785	.044	65.5	64.8	.921				
		3 p. m	785	23.994	68.7	66.9	.935				
		5 p. m	785	.970	58.5	58.9	.939				
		9 p. m	785	24.034	29.8	28.8	24.030				
Do	Nov. 23	7 a. m	785	23.914	16.5		23.888				
		9 a. m	785	.956	34.5	34.7	.881				
		12 m	785	.988	64.3	64	.868				
		3 p. m	785	.976	68.7	69.5	.917				
		5 p. m	785	.962	60.3	60.5	.927				
		9 p. m	785	.936	32.3	32.5	.921				
Do	Nov. 24	7 a. m	785	.978	27	25.5	.929				
		9 a. m	785	24.020	43.2	44.5	.927				
		12 m	785	.037	70.5	70.5	.903				
		3 p. m	785	.004	66.8	67.5	.949				
		6 p. m	785	23.980	58.8	58.5	.938				
		9 p. m	785	.964	36.2	36	.941				
Do	Nov. 25	7 a. m	785	.936	24.5	23.5	.893				
		9 a. m	785	.984	36.5	36.9	.906				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 70, Zuñi river	Nov. 25	12 m	785	24.022	59.3	60.8	23.913				
		3 p. m	785	23.966	62.8	62.7	24.006				
		6 p. m	785	.944	55.3	54.5	23.915				
		9 p. m	785	.928	31	31	.916				
Do	Nov. 26	7 a. m	785	.912	26.7		.885				
		9 a. m	785	.964	43.8	43.8	.892				
Do	Nov. 20	3 p. m	790	24.012	59.5	61.5	24.005				
		5 p. m	790	.020	53.5	52.7	.030				
		9 p. m	790	.028	29.3	28	.055				
Do	Nov. 21	7 a. m	790	.050	20.5		.037				
		9 a. m	790	.086	36.5	38	.038				
		12 m	790	.096	64.5	68	.013				
		3 p. m	790	.066	65.5	66.5	.046				
		5 p. m	790	.042	57.7	56.3	.045				
		9 p. m	790	.006	32.6	32.7	.019				
Do	Nov. 22	7 a. m	790	23.995	22		23.988				
		9 a. m	790	24.028	35.5	36	.984				
		12 m	790	.034	65.5	64.8	.946				
Do	Nov. 23	3 p. m	790	23.960	68.7	66.9	.927				
		5 p. m	790	.934	60.3	60.5	.930				
		9 p. m	790	.930	32.3	32.5	.946				
Do	Nov. 24	9 a. m	790	24.010	43.2	44.5	.950				
		12 m	790	.038	70.5	70.5	.937				
		3 p. m	790	23.985	66.8	67.5	.951				
		6 p. m	790	.963	58.8	58.5	.953				
		9 p. m	790	.978	36.2	36.0	.984				
Do	Nov. 25	7 a. m	790	.934	24.5	23.5	.922				
		9 a. m	790	.962	36.5	36.9	.914				
		12 m	790	24.010	59.3	60.8	.932				
		3 p. m	790	23.932	62.8	62.7	.919				
		6 p. m	790	.916	55.3	54.5	.914				
		9 p. m	790	.904	31	31	.923				
Do	Nov. 26	7 a. m	790	.898	27.2	26.5					
		9 a. m	790	.931	41.8	43.8		23.867			
Station 1	----do----	12 m	785	23.937	57.8	58.4	23.842				
Camp 71	----do----	3 p. m	785	23.946	60.4	59	23.906				
		Sunset	785	.934	54.2	54	.912				
		9 p. m	785	.962	48.5	48.5	.912				
Do	Nov. 27	Sunrise	785	.846	44.5	44.5	.761				
		9 a m	785	.854	38.5	38.8	.772				
		12 m	785	.845	41.2	42	.774				
		3 p. m	785	.820	48	49	.806				
		5 p. m	785	.816	42.3	42	.820				
		9 p. m	785	.798	35.2	35.5	.777				
Do	Nov. 28	Sunrise	785	.900	23.5	32.5	.859				
		9 a. m	785	.928	33.8	33.3	.855	23.844			
Station bet. 4 & 5	----do----	12 m	785	24.052	44.5	46.2	23.973				
Station M	----do----	3 p. m	785			46.5	23.973				
Camp 72	----do----	Sunset	785	23.989	57.5	58.5	23.960				
		9 p. m	785	24.004	31.7	36	23.989				
Do	Nov. 29	Sunrise	785	.040	35	35	.974				
		9 a. m	785	.046	37.8	44.8	.964	23.999			
Station 8	----do----	12 m	785	24.029	51.7	52	23.935				
Station 12	----do----	3 p. m	785	23.950	59.3	59	23.913				
Sta. bet. 16 & 17	----do----	Sunset	785	24.928	54.6	50	24.299				
Camp 73	----do----	9 p. m	785	24.322	39	37.5	24.292				
Do	Nov. 30	Sunrise	785	24.322	37.5	30	24.251				
		9 a. m	785	.391	53.8	53.8	.273	24.147			
Station C	----do----	12 m	785	24.490	49.7	50	24.299				
Camp 74	----do----	3 p. m	785	24.660	56.8	56	24.626				
		Sunset	785	.648	53.2	53	.626				
		9 p. m	785	.615	36	36.3	.592				
Do	Dec. 1	Sunrise	785	.610	21	20.5	.575				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 74	Dec. 1	9 a. m.	785	24.670	47.3	41.5	24.566	24.428			
Station C	do	12 m	785	24.771	52.5	56.3	24.674				
Station L	do	3 p. m.	785	24.624	57.8	59.5	24.587				
Camp 75	do	Sunset	785	24.733	57.8	59.3	24.701				
		9 p. m.	785	.682	31.7	34.7	.667				
		Sunrise	785	.722	25.5	24.5	.678				
Do	Dec. 2	9 a. m.	785	.762	45.2	42.5	.663	24.525			
Station B	do	12 m	785	24.608	55.7	53.7	24.504				
Station K	do	3 p. m.	785	24.657	64.8	60.9	24.605				
Camp 76	do	Sunset	785	24.775	65.4	59.5	24.726				
		9 p. m.	785	.736	38.3	38.3	.708				
Do	Dec. 3	Sunrise	785	.698	26.5	26.3	.651				
		9 a. m.	785	.797	43.7	44	.701	24.574			
Station P	do	12 m	785	25.035	56	59.5	24.930				
Station 7	do	3 p. m.	785	24.959	66.2	64	24.903				
Station Z	do	Sunset	785	25.076	62.3	54	25.021				
Camp 77	do	9 p. m.	785	25.068	33.8	32.3	25.049				
Do	Dec. 4	Sunrise	785	.032	25.3	25	24.987				
		9 a. m.	785	.100	47.8	44.3	.994				
		12 m	785	.073	57.7		.963				
		3 p. m.	785	.038	61.5		.992				
		5 p. m.	785	.054	66.7	73.3	25.001				
		9 p. m.	785	24.996	30	31.3	24.986				
Do	Dec. 5	7 a. m.	785	25.000	19.5	19.5	.968	24.908			
Station E	do	12 m	785	25.072	64.6		24.948				
Camp 78	do	3 p. m.	785	25.180	67.5	65.2	25.120				
		Sunset	785	.182	57.7	58.2	.149				
		9 p. m.	785	.202	35.5	37	.182				
Do	Dec. 6	Sunrise	785	.248	19.5	20.2	.218				
		9 a. m.	785	.315	38.6	39	.229	25.027			
Station 8	do	3 p. m.	785	25.353	60.3	59.3	25.310				
Station E	do	Sunset	785	25.378	53.8	51.3	25.348				
Camp 79	do	9 p. m.	785	25.432	30.8	27.9	25.419				
Do	Dec. 7	Sunrise	785	.416	12		.402				
		9 a. m.	785	.474	32.8	36.7	.402	25.167			
Station B	do	12 m	785	25.504	51.8	56.5	25.406				
Camp 80	do	3 p. m.	785	25.557	68.7	64.2	25.493				
		Sunset	785	.510	58.7	50.8	.473				
		9 p. m.	785	.449	25.5	25.5	.449				
Do	Dec. 8	Sunrise	785	.405	15	15	.384				
		9 a. m.	785	.434	26.4	26.8	.378	25.249			
Station 6	do	12 m	785	25.448	50.6	56.3	25.353				
Camp 81	do	3 p. m.	785	25.388	57.7	55.9	25.340				
		3 p. m.	790	.383	57.7	55.9	.382				
		Sunset	785	.342	45.5	44	.336				
		Sunset	790	.332	45.5	44	.357				
		9 p. m.	790	.290	29.5	30.6	.315				
		9 p. m.	785	.284	29.5	30.6	.275				
Do	Dec. 9	Sunrise	785	.176	27	27.5	.127				
		Sunrise	790	.182	27	27.5	.164				
		9 a. m.	790	.187	31.8	32.5	.150				
		9 a. m.	785	.194	31.8	32.5	.124	25.231			
Camp 82	Dec. 10	7 a. m.	785	25.110	33.0	33.0	25.048				
		7 a. m.	790	.118	33.0	33.0	.086				
		9 a. m.	790	.141	43.7	44.0	.067				
		9 a. m.	785	.132	43.7	44.0	.035				
		12 m.	785	.128	48.5	49.8	.034				
		12 m.	790	.123	48.5	49.8	.068				
		3 p. m.	790	.063	58.6	59.9	.054				
		3 p. m.	785	.063	58.6	59.9	.023				
		5 p. m.	785	.084	52.3	53.0	.053				
		5 p. m.	790	.074	52.3	53.0	.084				
		9 p. m.	790	.066	48.5	49.5	.044				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 82	Dec. 10	9 p. m	785	25.068	48.5	49.5	25.016				
Do	Dec. 11	7 a. m	785	.076	43.5	43.8	24.990				
		7 a. m	790	.086	43.5	43.8	25.033				
		9 a. m	785	.146	50.0	49.9	.036				
		9 a. m	790	.134	50.0	49.9	.049				
		12 m	785	.153	58.0	59.0	.043				
		12 m	790	.176	58.0	59.0	.106				
		3 p. m	785	.151	52.2	52.3	.126				
		3 p. m	790	.148	52.2	52.3	.153				
		5 p. m	785	.170	48.6	49.2	.157				
		5 p. m	790	.206	48.6	49.2	.225				
		9 p. m	785	.228	39.3	42.6	.196				
Do	Dec. 12	9 p. m	790	.220	39.3	42.6	.218				
		7 a. m	785	.260	35.8	38.0	.191				
		7 a. m	790	.250	35.8	38.0	.211				
		9 a. m	785	.260	37.9	38.5	.177				
		9 a. m	700	.250	37.9	38.5	.198				
		12 m	785	.241	46.7	47.8	.156				
		12 m	790	.208	46.7	47.8	.155				
		3 p. m	785	.134	49.5	50.0	.115				
		3 p. m	790	.130	49.4	50.0	.142				
		5 p. m	785	.096	46.5	47.8	.099				
		5 p. m	790	.108	46.6	47.8	.137				
		9 p. m	785	.092	40.0	42.0	.060				
		9 p. m	790	.082	40.8	42.0	.080				
Do	Dec. 13	7 a. m	785	.050	41.6	42.0	24.969				
		7 a. m	790	.042	41.2	42.0	.992				
		9 a. m	785	.058	42.0	43.5	.966				
		9 a. m	790	.052	42.4	43.5	.990				
		12 m	785	.052	60.1	60.8	.938				
		12 m	790	.046	58.5	60.8	.967				
		3 p. m	785	24.990	59.2	59.2	.950				
		3 p. m	790	.992	59.0	59.2	.983				
		5 p. m	785	.972	47.0	47.6	.964				
		5 p. m	790	.976	46.5	47.6	25.000				
		9 p. m	785	25.004	39.5	40.0	24.972				
		9 p. m	790	.002	41.5	40.0	.997				
Do	Dec. 14	7 a. m	785	.024	30.0	30.8	.969				
		7 a. m	790	.020	30.0	30.8	.996				
		9 a. m	785	.062	51.0	44.5	.950				
		9 a. m	790	.072	43.5	44.5	25.007	25.289			
Station 4	do	12 m	785	25.060	42.0	42.0	24.986				
		12 m	790								
Camp 83	do	3 p. m	785	25.058	44.5	44.0	25.050				
		3 p. m	790	.054	44.5	44.0	.077				
		5 p. m	785	.052	36.2	36.0	.068				
		5 p. m	790	.046	36.5	36.0	.092				
		9 p. m	785	.062	28.0	28.5	.056				
		9 p. m	790	.054	28.0	28.5	.079				
Do	Dec. 15	7 a. m	785	.030	24.5	25.0	24.987				
		7 a. m	790	.026	24.6	25.0	25.014				
		9 a. m	785	.073	38.5	37.4	24.982				
		9 a. m	790	.086	41.8	37.4	25.026				
		12 m	785	.058	42.5	43.7	24.973				
		12 m	790	.070	47.0	43 7	25.016				
		3 p. m	785	.052	32.5		.071				
		3 p. m	790	.052	32.5		.103				
		5 p. m	785	.094	33.0	33.0	.122				
		5 p. m	790	.094	33.0	33.0	.148				
		9 p. m	785	.132	30.0	30.2	.122				
		9 p. m	790	.140	29.9	30.2	.161				
Do	Dec. 16	7 a. m	785	.218	7.5		.214				
		7 a. m	790	.212	7.5		.238				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 83	Dec. 16	9 a. m.	785	25.232	34.0	37.5	25.158				
		9 a. m.	790	.300	46.8	37.5	.228	25.299			
Station 2	do	12 m	785	.344	36.5	35.0	.283				
Camp 84	do	3 p. m.	785	.328	40.0	40.2	.330				
		3 p. m.	790	.330	44	40.2	.364				
		5 p. m.	785	.296	32.0	31.9	.320				
		5 p. m.	790	.298	31.5	31.9	.354				
		9 p. m.	785	.305	12.0		.335				
		9 p. m.	790	.303	11.8		.329				
Do	Dec. 17	7 a. m.	785	.334	8.0		.329				
		7 a. m.	790	.336	8.0		.361				
		9 a. m.	785	.422	27.0	31.0	.363				
		9 a. m.	790	.416	25.7	31.0	.393	25.348			
Station C	do	12½ p. m.	785	.382	44.5	51.0	.302				
Station 7	do	3 p. m.	785	.426	49.5	54.9	.405				
Camp 85	do	5 p. m.	785	.419	47.5	46.5	.409				
		5 p. m.	790	.416	46.5	46.5	.439				
		9 p. m.	785	.372	20.5	21.9	.382				
		9 p. m.	790	.368	20.5	21.9	.411				
Do	Dec. 18	7 a. m.	785	.376	8.5		.370				
		7 a. m.	790	.372	8.5		.399				
		8 a. m.	785	.403	12.7		.382				
		8 a. m.	790	.398	16.9		.398				
		9 a. m.	785	.442	28.5	31.0	.380				
		9 a. m.	790	.438	28.1	31.0	.408				
		10 a. m.	785	.456	32.5	34.0	.378				
		10 a. m.	790	.458	34.4	34.0	.408				
		11 a. m.	785	.456	36.6		.356				
		11 a. m.	790	.458	37.6		.388				
		12 m	785	.448	42.5	48.2	.372				
		12 m	790	.447	43.4	48.2	.401				
		1 p. m.	785	.435	48.1	49.5	.387				
		1 p. m.	790	.430	47.5	49.5	.414				
		2 p. m.	785	.424	48.9	51.0	.385				
		2 p. m.	790	.424	54.5	51.0	.415				
		3 p. m.	785	.430	50.9	53.9	.407				
		3 p. m.	790	.432	55.0	53.9	.431				
		4 p. m.	785	.416	48.0	44.5	.409				
		4 p. m.	790	.412	46.0	44.5	.441				
		5 p. m.	785	.399	39.4	38.5	.408				
		5 p. m.	790	.400	37.5	38.5	.444				
		6 p. m.	785	.386	30.5	30.5	.404				
		6 p. m.	790	.390	31	30.5	.438				
		7 p. m.	785	.389	29.5	29	.400				
		7 p. m.	790	.390	29.9	29	.430				
		8 p. m.	785	.394	22	22	.407				
		8 p. m.	790	.394	21.9	22	.438				
		9 p. m.	785	.386	12		.417				
		9 p. m.	790	.392	12		.454				
Do	Dec. 19	7 a. m.	785	.388	10.5		.377				
		7 a. m.	790	.392	11.5		.413				
		9 a. m.	785	.426	22.8	23.5	.377				
		9 a. m.	790	.428	23.5	23.5	.408	25.386			
Station A	do	12 m.	785	.412	35.9	36	.383				
Camp 86	do	3 p. m.	785	.344	42	40.9	.341				
		3 p. m.	790	.338	42	40.9	.367				
		6 p. m.	785	.324	35	35.2	.332				
		6 p. m.	790	.318	35	35.2	.357				
		9 p. m.	785	.284	20	20.5	.258				
		9 p. m.	790	.280	20	20.5	.285				
Do	Dec. 20	7 a. m.	785	.290	10		.280				
		7 a. m.	790	.280	10.1		.301				
		9 a. m.	785	.326	29.5	30	.262				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Camp 86	Dec. 20	9 a. m.	790	25.318	27	30	25.290	25.382			
Camp 87	do	12 m.	785	.322	51.6	57	.226				
		3 p. m.	785	.312	54.5	55.2	.282				
		3 p. m.	790	.310	51.6	55.2	.317				
		5 p. m.	785	.314	42.5	42	.316				
		5 p. m.	790	.308	42	42	.341				
		9 p. m.	785	.314	45.5		.296				
		9 p. m.	790	.307	33.5	34	.320				
Do	Dec. 21	7 a. m.	785	.294	33.5	34	.244				
		7 a. m.	790	.286	27.5	27.5	.276				
		9 a. m.	785	.318	34.6	34.8	.244				
		9 a. m.	790	.302	40.3	34.8	.255				
		12 m.	785	.264	53.7	54.6	.164				
		12 m.	790	.288	54.3	54.6	.217				
		3 p. m.	785	.274	55.5	52	.242				
		3 p. m.	790	.268	52.5	52	.273				
		5 p. m.	785	.278	46.7	45.8	.270				
		5 p. m.	790	.264	45.7	45.8	.289				
		9 p. m.	785	.268	38.5	39.5	.239				
		9 p. m.	790	.272	39.5	39.5	.271				
Do	Dec. 22	7 a. m.	785	.250	27.5	27.5	.200				
		7 a. m.	790	.244	27.5	27.5	.226				
		9 a. m.	785	.282	37.7		.199				
		9 a. m.	790	.274	38.7		.226	25.396			
Station A	do	12 m.	785	.053	51.2		24.959				
Station 17	do	3 p. m.	785	24.746	49.5		.696				
Camp 88	do	7½ p. m.	790	.676	39.5	37.8	.685				
		9 p. m.	790	.687	37.7		.690				
Do	Dec. 23	7 a. m.	790	.726	28	30	.705				
		9 a. m.	790	.767	28.5	30	.735	24.741			
Station 7	do	12 m.	785	.170	28.6		.136				
Station 12	do	3 p. m.	785	23.966	35.7		23.755				
Camp 89*	do	5 p. m.	785	.966	23.2		24.006				
Do	Dec. 24	7 a. m.	785	.966	3.5		23.983				
		9 a. m.	785	24.039	26.7	26.7	.977				
		9 a. m.	790	23.991	20.5	26.7	.977				
		12 m.	785	24.005	45.5	51.6	.925				
		12 m.	790	23.980	44	51.6	.934				
		3 p. m.	785	.962	47.2	53.8	.950				
		3 p. m.	790	.940	47.2	53.8	.959				
		6 p. m.	785	.928	33.3	34.9	.953				
		6 p. m.	790	.906	34	34.9	.948				
		9 p. m.	785	.876	15.3		.908				
		9 p. m.	790	.862	15.5		.904				
Do	Dec. 25	7 a. m.	785	.924	5.5	5.5	.922				
		7 a. m.	790	.934	6.5	5.5	.960				
		9 a. m.	785	24.050	28.5	33	.998				
		9 a. m.	790	.050	26.5	33	24.022				
		12 m.	785	.048	38.5	39	23.982				
		12 m.	790	.047	39.8	39	24.099				
		3 p. m.	785	.028	42.5	46.2	.026				
		3 p. m.	790	.034	43	46.2	.062				
		5 p. m.	785	.012	35	37	.031				
		5 p. m.	790	.018	36.2	37	.065				
		9 p. m.	785	.020	17		.038				
		9 p. m.	790	.034	17		.083				
Do	Dec. 26	7 a. m.	785	.034	3		.037				
		7 a. m.	790	.022	3		.056				
		9 a. m.	785	.080	21	25	.034				
		9 a. m.	790	.074	21.6		.058				
Station C	do	12 m.	785	23.958	50.7		23.874	24.098			

* Altitude determined from corresponding observations at Camp 86.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Station F	Dec. 26	2.40 p. m.	785	23.430	45.5	------	23.417	------	------	------	------
Camp 90	----do----	5 p. m.	785	.482	39.7	40.3	.491	------	------	------	------
		9 p. m.	785	.510	35.5	36.3	.488	------	------	------	------
Do	Dec. 27	7 a. m.	785	.528	29	30	.475	------	------	------	------
		9 a. m.	785	.567	32.1	33.2	.498	23.590	------	------	------
Station 13	----dc----	12 m.	785	.298	44	------	.122	------	------	------	------
Station D	----dc----	3 p. m.	785	.122	37.5	------	.132	------	------	------	------
Camp 91*	----dc----	9 p. m.	785	.028	29.5	30.2	.019	------	------	------	------
Do	Dec. 28	7 a. m.	785	.006	23.5	23.5	22.964	------	------	------	------
		9 a. m.	785	.062	46.8	------	.960	------	------	------	------
		9 a. m.	790	.020	44.8	------	.955	------	------	------	------
		12 m.	785	.008	61.5	71	.896	------	------	------	------
		12 m.	790	22.986	60.8	71	.906	------	------	------	------
		3 p. m.	785	.964	48.5	51.6	.950	------	------	------	------
		3 p. m.	790	.952	49	51.6	.969	------	------	------	------
		6 p. m.	785	.939	42	47.7	.934	------	------	------	------
		6 p. m.	790	.920	42.3	47.7	.956	------	------	------	------
		9 p. m.	785	.938	44.9	45.3	.897	------	------	------	------
		9 p. m.	790	.916	45.3	45.3	.906	------	------	------	------
		7 a. m.	785	.854	36.5	37.5	.786	------	------	------	------
		7 a. m.	790	.828	36.7	37.5	.790	------	------	------	------
		9 a. m.	785	.886	38.5	39.5	.803	------	------	------	------
		9 a. m.	790	.848	37.5	39.5	.798	------	------	------	------
		12 m.	785	.844	41.7	45.2	.773	------	------	------	------
		12 m.	790	.815	42.6	45.2	.773	------	------	------	------
		3 p. m.	785	.811	43.7	45.9	.808	------	------	------	------
		3 p. m.	790	.806	43.7	45.9	.834	------	------	------	------
		6 p. m.	785	.814	38	38.7	.817	------	------	------	------
		6 p. m.	790	.806	38.5	38.7	.849	------	------	------	------
Camp 91	Dec. 29	9 p. m.	785	.828	28	29.5	.822	------	------	------	------
		9 p. m.	790	.816	29.6	29.5	.838	------	------	------	------
Do	Dec. 30	7 a. m.	785	.802	12.5	------	.783	------	------	------	------
		7 a. m.	790	.820	12.7	------	.832	------	------	------	------
		9 a. m.	785	.852	30	31	.787	------	------	------	------
		9 a. m.	790	.854	30.5	31	.819	------	------	------	------
		12 m.	785	.898	41.2	49	.828	------	------	------	------
		12 m.	790	.886	41.6	49	.846	------	------	------	------
		3 p. m.	785	.914	32	------	.935	------	------	------	------
		3 p. m.	790	.908	32.9	------	.958	------	------	------	------
		5 p. m.	785	.920	24.5	25.6	.961	------	------	------	------
		5 p. m.	790	.911	25	25.6	.985	------	------	------	------
		9 p. m.	785	.918	17.5	------	.934	------	------	------	------
		9 p. m.	790	.914	18	------	.960	------	------	------	------
Do	Dec. 31	7 a. m.	785	.986	15	------	.962	------	------	------	------
		7 a. m.	790	.976	15.6	------	.982	------	------	------	------
		9 a. m.	785	23.054	33.4	39.5	.982	------	------	------	------
		9 a. m.	790	.040	33.6	39.5	23.013	22.886	------	------	------
Station 7	----do----	12 m.	785	22.910	47.5	45	22.928	------	------	------	------
Camp 92	----do----	3 p. m.	785	23.013	48.5	44.5	23.000	------	------	------	------
		5 p. m.	785	22.980	34.5	34.8	.001	------	------	------	------
		5 p. m.	790	.980	37.8	34.8	.024	------	------	------	------
		9 p. m.	785	23.026	30	30.2	.016	------	------	------	------
		9 p. m.	790	.018	30	30.2	.039	------	------	------	------
	1854.										
Do	Jan. 1	7 a. m.	785	.048	29.5	29	22.995	------	------	------	------
		7 a. m.	790	.032	29.5	29	23.009	------	------	------	------
		9 a. m.	785	.086	39.9	41	.000	------	------	------	------
		9 a. m.	790	.076	40.6	41	.019	22.877	------	------	------
Station C	----do----	12 m.	785	.180	51	55	.090	------	------	------	------
Camp 93	----do----	3 p. m.	785	.184	55.7	49.5	------	------	------	------	------
		5 p. m.	785	.166	35.5	36.2	.184	------	------	------	------

* Altitude determined by comparison with corresponding observations at Camp 85.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 93	Jan. 1	5 p. m.	790	23.162	37	36.2	23.208				
		9 p. m.	785	.140	32.6	33.9	.124				
		9 p. m.	790	.134	33	33.9	.149				
		7 a. m.	785	.144	24.5	24	.100				
Do.	Jan. 2	7 a. m.	790	.130	24.6	24	.116				
		9 a. m.	785	.190	39	41.6	.106				
		9 a. m.	790	.178	37.5	47.5	.108				
		12 m.	785	.424	51.5	47.5	.233	23.049			
Station 12	----do----	3 p. m.	785	23.704	42	50	23.703				
Camp 94	----do----	7 a. m.	785	23.632	20.9	20	23.596				
Do.	Jan. 3	7 a. m.	790	.620	21	20	.615				
		9 a. m.	785	.642	46.9	47.5	.541				
		9 a. m.	790	.632	47	47.5	.562				
		10 a. m.	785	.646	51.2		.529				
		10 a. m.	790	.650	51	47.5	.565				
		11 a. m.	785	.522	50		.395				
		11 a. m.	790	.616	51.5	47.5	.517				
		12 m.	785	.518	53.5		.421				
		12 m.	790	.604	57.4	47.5	.530				
		1 p. m.	785	.500	57.4	61	.435				
		1 p. m.	790	.594	59	61	.559				
		2 p. m.	785	.588	56		.548				
		2 p. m.	790	.572	55.9	61	.563				
		3 p. m.	785	.574	51	53	.555				
		3 p. m.	790	.582	54	53	.587				
		4 p. m.	785	.550	49.4		.544				
		4 p. m.	790	.542	46	53	.587				
		5 p. m.	785	.556	33.9		.577				
		5 p. m.	790	.520	36	53	.568				
		7 p. m.	785	.504	31.5		.516				
		7 p. m.	790	.506	32	53	.543				
		8 p. m.	785	.514	36.5		.495				
		8 p. m.	790	.520	36.5	53	.532				
		9 p. m.	785	.500	30.5	33	.489				
		9 p. m.	790	.500	31	33	.519				
Do.	Jan. 4	7 a. m.	785	.412	30	30.1	.357				
		7 a. m.	790	.380	30.5	30.1	.355				
		9 a. m.	785	.442	39.7	38.9	.357				
		9 a. m.	790	.424	37.9	38.9	.393				
		12 m.	785	.370	41	42.4	.300				
		12 m.	790	.372	41.8	42.4	.332				
		3 p. m.	785	.340	43	43	.338				
		3 p. m.	790	.330	43.4	43	.358				
		5 p. m.	785	.322	29.5	30	.341				
		5 p. m.	790	.299	35	30	.349				
		9 p. m.	785	.312	29.5	30	.303				
		9 p. m.	790	.296	30.5	30	.316				
Do.	Jan. 5	7 a. m.	785	.268	27.8	28	.217				
		7 a. m.	790	.276	28	28	.256				
		9 a. m.	785	.294	35.8	36	.214				
		9 a. m.	790	.286	36	36	.239				
		12 m.	785	.264	43.6	46.7	.189				
		12 m.	790	.257	44.2	46.7	.212				
		3 p. m.	785	.244	35	36	.259				
		3 p. m.	790	.238	35.6	36	.283				
		6 p. m.	785	.272	34	35	.298				
		6 p. m.	790	.265	34.5	35	.317				
		9 p. m.	785	.263	32.5	34.2	.248				
		9 p. m.	790	.254	34.9	34.2	.264				
Do.	Jan. 6	7 a. m.	785	.336	22	23	.298				
		7 a. m.	790	.336	22.6	23	.360				
		9 a. m.	785	.376	22.6	24	.322				
		9 a. m.	790	.386	23.5	24	.383				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 94	Jan. 6	12 m.	785	23.388	28.5	30.1	23.344				
		12 m.	790	.398	29.6	30.1	.493				
		3 p. m.	785	.440	28.5	28.5	.468				
		3 p. m.	790	.436	29.5	28.5	.555				
		5 p. m.	785	.482	23	22.9	.527				
		5 p. m.	790	.480	23.5	22.9	.597				
		9 p. m.	785	.586	28.2	23	.579				
		9 p. m.	790	.560	22.3	23	.661				
Do	Jan. 7	7 a. m.	785	.654	11.5		.638				
		7 a. m.	790	.646	11.5	23	.693				
		9 a. m.	785	.736	30	34.5	.665				
		9 a. m.	790	.726	29.5	34.5	.690				
		12 m.	785	.732	38.7	43.7	.666				
		12 m.	790	.728	40.5	43.7	.742				
		3 p. m.	785	.717	38.5	40.5	.742				
		3 p. m.	790	.708	40.5	40.5	.742				
		9 p. m.	785	.674	27		.675				
		9 p. m.	790	.692	25.5		.762				
Do	Jan. 8	7 a. m.	785	.724	30.6	31.5	.667				
		7 a. m.	790	.718	31	31.5					
		9 a. m.	785	.732	35.8	37	.709				
		9 a. m.	790	.708	36	37		23.451			
Station C	do	12 m.	785	23.764	51		23.672				
Camp 95	do	5 p. m.	785	23.976	41		23.982				
		9 p. m.	785	.974	35	35.3	.953				
Do	Jan. 9	7 a. m.	785	.924	19		.893				
		9 a. m.	785	.960	42.5	44.2	.868	23.838			
Station 6	do	12 m.	785	24.032	50		23.942				
Station 13	do	3 p. m.	790	24.286	49.5		24.257				
Camp 96	do	Sunset	790	24.362	37.8	37.8	24.406				
		9 p. m.	790	.368	28.6	29.8	.392				
Do	Jan. 10	Sunrise.	790	.382	29	28.5	.360				
		9 a. m.	790	.428	34.5	34.7	.384				
		9 a. m.	784	.454	34	34.7		24.376			
Station 14	do	12 m.	784	24.714	43.6	42.9	24.625				
Camp 97	do	3 p. m.	784	25.008	45	49	24.987				
		Sunset.	784		38.3	38	.999				
		9 p. m.	784	24.988	26.5	26.8	.974				
Do	Jan. 11	7 a. m.	784	25.010	20.5	20.5	.964				
		7 a. m.	790								
		9 a. m.	784	.026	34.3	40	.939				
		9 a. m.	790								
		12 m.	784	24.984	55.6	63	.868				
		12 m.	790	.970	55	54.5	.897				
		3 p. m.	784	.930	59.2	48	.898				
		3 p. m.	790	.904	63.5	59.9	.904				
		5 p. m.	784	.888	41.5	42.5	.885				
		5 p. m.	790	.862	42	42.5	.896				
		9 p. m.	784	.826	25	27	.815				
		9 p. m.	790	.806	25	27	.838				
Do	Jan. 12	7 a. m.	790	.734	16		.741	24.921			
Camp 98	do	12 m	784	24.930	55	54.5	24.815				
		3 p. m.	784	.904	63.5	59.9	.842				
		3 p. m.	790	.894	62.5	59.9	.877				
		5 p. m.	784	.890	48.5	49	.866				
		5 p. m.	790	.864	49.5	49	.881				
		9 p. m.	784	.876	27	27.5	.861				
		9 p. m.	790	.858	27.5	27.5	.884				
Do	Jan. 13	7 a. m.	784	.898	20.5	21	.852				
		7 a. m.	790	.879	21.5	21	.874				
		9 a. m.	784	.930	4.30		.824	25.044			
Station A	do	12 m.	784	25.020	52	56	24.911				
Station 15	do	3 p. m.	784	25.084	60	58	25.030				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 99	Jan. 13	Sunset	784	25.171	52.5	53	25.138				
		9 p. m	784	.166	47	43.5	.106				
Do	Jan. 14	7 a. m	784	.086	44.5	43.3	24.986				
		9 a. m	784	.080	48	48	.962				
		9 a. m	790	.056	47.2	48	.983				
		12 m	784	.038	51	51	.932				
		12 m	790	24.992	51	51	.929				
		3 p. m	784	.980	50	51	.948				
		3 p. m	790								
Do	Jan. 15	7 a. m	784	.928	26.5	27	.869				
		7 a. m	790	.872	27	27	.854				
		9 a. m	784	.972	33	32.5	.888				
		9 a. m	790	.950	33	32.5	.909				
		12 m	784	.992	38	38	.915				
		12 m	790	.970	39	38	.933				
		3 p. m	784	25.011	37.2	36.9	25.008				
		3 p. m	790	24.982	37	36.9	.022				
		Sunset	784	.998	32.5	32.5	.010				
		Sunset	790	.962	32.5	32.5	.017				
		9 p. m	784	25.046	25	26	.035				
		9 p. m	790		25	26	.032				
Do	Jan. 16	7 a. m	784	.003	10		.031				
		7 a. m	790	.024	11		.042			0	Cirrus, 3
		9 a. m	784	.116	30	33.5	.029		S.E	.5	Cirro-stratus, 3
		9 a. m	790	.088	30.5	33.5	.052	25.170			
Camp 100	do	12 m	784	25.212	41.2		25.127		S.E	2	Nim.&cir.-cu.9
		3 p. m	784	.200	43		.183		S.E	3	do 9
		5 p. m	784	.193	29		.213		S.E	.1	do 9
Do	Jan. 17	7½ a. m	784	.291	32		.217		S.W	.5	Nimbus, 7
		9 a. m	784	.378	55.5		.243			0	Cirro-cum., 5
		12 m	784	.340	57		.229		S.E	.1	Cirrus, 7.
		3 p. m	784	.326	59		.272		S.E	2	Cirrus, 6.
		5 p. m	784	.281	39.5		.277			0	None.
		9 p. m	784	.280	21.5		.277		S.E	.1	Cirro-cum., 8.
Do	Jan. 18	9 a. m	784	.270	42.5		.165				
Do	Jan. 19	7 a. m	784	24.895	35.5		24.815				
		9 a. m	784	.935	44		.826	25.266			
Camp 101	do	3 p. m	784	24.660	35	33	24.662				
		5 p. m	784	.702	29	29	.722				
		8 p. m	784	.706	24.5	24	.701				
Do	Jan. 20	7 a. m	784	.892	8.5		.873				
		9 a. m	784	.996	19.5	22	.942	24.862			
Station 5	do	12 m	784	24.704	20.0		24.667				
Station 10	do	3 p. m	784	24.814	20.5	20	24.850				
Camp 102	do	Sunset	784	24.554	10		24.616				
		9 p. m	784	.544	5		.599				
Do	Jan. 21	7 a. m	784	.582			.581				
		9 a. m	784	.564	35.5	28.5	.554	24.398			
Station 5	do	12 m	784	24.608	39.5	37.5	24.528				
Camp 103	do	3 p. m	784	24.998	43.5	43.7	24.981				
		3 p. m	783	25.006	54.5	43.7	.964				
		5 p. m	784	24.992	32.2	34	25.002				
		5 p. m	783	25.010	33.7	34	.002				
		9 p. m	784	24.986	20.5		24.985				
		9 p. m	783	.944	21.5	23	.991				
Do	Jan. 22	7 a. m	784	25.064	26.3	26	25.005				
		7 a. m	783	.070	26	26	.012				
		9 a. m	784	.084	32	33.5	.002				
		9 a. m	783	.102	32	33.5	.020	24.796			
Station C	do	12 m	784	24.946	47.7		24.846				
Station 14	do	3 p. m	784	24.556	45.5	43.9	24.537				
Station 17	do	Sunset	784	24.528	45.5		24.509				
Camp 104	do	9 p. m	784	24.536	25	26	24.525				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 104	Jan. 23	7 a. m	784	24.508	26	26.8	24.450				
		9 a. m	784	.536	44.5	42.5	.427	24.354			
Station 6	do	12 m	790	23.957	55	57	23.887				
Camp 105	do	3 p. m	790	24.426	54	54.8	24.429				
		3 p. m	784	.485	55.7	54.8	.442				
		5 p. m	790	.392	39	48.9	.433				
		5 p. m	784	.442	40	48.9	.438				
		9 p. m	790	.400	37	38	.405				
		9 p. m	784	.418	37	38	.380				
Do	Jan. 24	7 a. m	790	.366	38.9	39.9	.323				
		7 a. m	784	.402	39.7	39.9	.314				
		9 a. m	790	.396	58	50	.317				
		9 a. m	784	.429	58	50	.306	24.362			
Station D	do	12 m	790								
Camp 106	do	3 p. m	790	24.750	56.5	55.1	24.748				
		3 p. m	784	.767	56	55.1	.722				
		5 p. m	790	.712	42.5	43.1	.744				
		5 p. m	784	.761	42.3	43.1	.752				
		9 p. m	790	.682	39.5	40.9	.682				
		9 p. m	794	.740	39.5	40.9	.697				
Do	Jan. 25	7 a. m	790	.682	35.5	35	.651				
		7 a. m	784	.654	35	35	.576				
		9 a. m	790	.650	52.5	47	.566				
		9 a. m	784	.668	47.5	47	.552				
		12 m	790	.590	48.9	48.9	.530				
		12 m	784	.618	49.5	48.9	.516				
		3 p. m	790	.528	45	44.1	.551				
		3 p. m	784	.554	45	44.1	.534				
		5 p. m	790	.520	40.5	40	.558				
		5 p. m	784	.534	40	40	.532				
		9 p. m	790	.522	34	34	.534				
		9 p. m	784	.540	34	34	.509				
Do	Jan. 26	7 a. m	790	.634	11.5	11	.640				
		7 a. m	784	.651	11	11	.626				
		9 a. m	790	.734	36.6	49	.685				
		9 a. m	784	.756	38.5	49	.660				
		12 m	790	.792	39.5	48	.754				
		12 m	784	.800	40	48	.719				
		3 p. m	790	.786	44	42.5	.810				
		3 p. m	784	.800	40	42.5	.790				
		5 p. m	790	.780	32.5	31.5	.840				
		5 p. m	784	.798	32		.811				
		9 p. m	790	.840	18.5	18	.886				
		9 p. m	784	.845	18.5	18	.848				
Do	Jan. 27	7 a. m	790	.940	22	21	.934				
		7 a. m	784	.976	21.5	21	.928				
		9 a. m	790	.999	35	40	.953				
		9 a. m	784	25.030	35.5	40	.940	24.685			
Station 7	do	12 m	784	25.082	46.5	48	24.990				
Station 15	do	3 p. m	784	25.292	56	59	25.247				
Camp 107	do	Sunset	784	25.364	45	45	25.347				
		9 p. m	784	.370		30.5	.346				
		Sunrise	784	.336	26.5	27	.307				
		9 a. m	784	.360	47	50.5	.244	25.187			
Camp 108	Jan. 28	3 p. m	790	.276	59.5 in sun	65	25.267				
		3 p. m	784	.344	68.5	65	.270				
		5 p. m	790	.250	50.5	51.5	.265				
		5 p. m	784	.278	50	51.5	.250				
		9 p. m	790	.290	40	40	.284				
		9 p. m	784	.312	40	40	.267				
Do	Jan. 29	7 a. m	790	.254	29	28.5	.232				
		7 a. m	784	.320	28	28.5	.257				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 108	Jan. 29	9 a. m	790	25.354	61	54	25.249				
		9 a. m	784	.352	51.6	54	.226				
		12 m	790	.314	58.7	60.5	.231				
		12 m	784	.326	59.5	60.5	.199				
		3 p. m	790	.310	62	67	.293				
		3 p. m	784	.324	61	67	.266				
		5 p. m	790	.299	50.5	51	.313				
		5 p. m	784	.318	50	51	.290				
		9 p. m	790	.308	40.8	41	.306				
		9 p. m	784	.320	40.6	41	.273				
Do	Jan. 30	7 a. m	790	.346	30	31	.321				
		7 a. m	784	.367	30	31	.299				
		9 a. m	790	.418	59.5	49	.316				
		9 a. m	784	.414	49	49	.293	25.358			
Station B	do	12 m	784	25.320	58	59	25.197				
Station F	do	3 p. m	784	25.388	69.5	68	25.312				
Camp 109	do	5 p. m	784	25.360	52	49.6	25.327				
		9 p. m	784	.388	42	42.5	.278				
Do	Jan. 31	7 a. m	784	.296	29	30	.235				
		9 a. m	784	.273	51	50	.148	25.235			
Station 10	do	12 m	784	25.430	70	74	25.272				
Camp 110	do	4 p. m	784	24.976	72.6	73.9	24.904				
		5 p. m	784	.950	57	57.2	.907				
		9 p. m	784	.924	49.5	49	.858				
Do	Feb. 1	7 a. m	784	.800	41	41	24.708				
		9 a. m	784	.854	58	63.5	.714	24.954			
Station 1	do	10½ a. m	784	24.792	62		24.633				
		10½ a. m	783	.782	61.7		.623				
Station 6	do	3 p. m	784	25.984	73	69.5	25.897				
Camp 111	do	5 p. m	784	26.332	60	62	26.278				
		9 p. m	784	.340	41	43	.291				
		9 p. m	783	.334	41.5		.346				
Do	Feb. 2	7 a. m	784	.432	35.5	36	.352				
		7 a. m	783	.418	35.5		.338				
		9 a. m	784	.478	57.1	51	.336				
		9 a. m	783	.490	55		.353				
		12 m	784	.506	65.5		.361				
		12 m	783	.532	71.5	70.2	.375				
		3 p. m	784	.458	67.5	67.5	.382				
		5 p. m	784	.460	53.5	54	.422				
	Feb. 3	7 a. m	784	.466	38	38.5	.379				
		7 a. m	790	.460	38.1		.416				
		9 a. m	784	.428	59.5	61	.381				
		9 a. m	790	.512	57		.413				
		12 m	784	.516	68.6	68	.365				
		12 m	790	.509	67.6		.404				
		3 p. m	784	.474	69.5	68.8	.393				
		3 p. m	790	.460	68		.425				
		5 p. m	784	.457	61.5	62.1	.401				
		5 p. m	790	.442	61.5		.428				
Do		9 p. m	784	.440	44	46	.384				
		9 p. m	790	.440	45		.427				
Do	Feb. 4	7 a. m	784	.445	41	41.1	.341				
		7 a. m	790	.428	41.2		.371	26.461			
Station 1	do	9 a. m	784	26.644	55	56	26.507				
Camp 112	do	3 p. m	784	27.182	73	75	27.091				
		5 p. m	784	.150	63.4	63.5	.098				
		8.30 p. m	784	.142	39.5	40.5	.100				
Do	Feb. 5	7 a. m	784	.118	37	37.8	.033	27.178			
Station A	do	9 a. m	784	27.270	49.5	52.5	27.045				
Station 5	do	12 m	784	27.688	63.5	62.4	27.556				
Station 19	do	3 p. m	784	27.836	69.5	69.2	27.750				
Camp 113	do	5 p. m	784	27.844	63.6	64	27.778				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 113	Feb 5	9 p. m	784	27.818	50.5	52.2	27.744				
Do	Feb. 6	7 a. m	784	.828	39	40	.738				
		9 a. m	784	.908	63	61	.748	27.714			
Station A	do	12 m	784	27.950	71	70.2	27.788				
Station B	do	3 p. m	784	28.040	77.5	80	27.934				
Camp 114	do	5 p. m	784	28.124	64.6	63	28.055				
		9 p. m	784	.080	40.5	42	.031				
Do	Feb. 7	7 a. m	784	.072	30.5	32	.003	27.997			
Station A	do	9 a. m	784	28.232	69	63	28.057				
Camp 115	do	12 m	784	28.294	75.2	74.5	28.121				
		3 p. m	784	.234	73.5	69	.136				
		3 p. m	790	.190	69.5		.147				
		5 p. m	784	.220	62.5	63	.156				
		5 p. m	790	.182	62		.162				
		9 p. m	784	.226	56	56.4	.138				
		9 p. m	790	.200	56.2		.155				
Do	Feb. 8	7 a. m	784	.284	44.5	42.9	.180				
		7 a. m	790	.264	44.7		.202	28.120			
Station 1	do	9 a. m	784	28.352	63	60.2	28.191				
Station 8	do	12 m	784	28.401	72	73	28.234				
Camp 116	do	3 p. m	784	28.418	81	75	28.301				
		3 p. m	790	.392	74		.336				
		5 p. m	784	.361	65.2	66	.290				
		5 p. m	790	.363	65		.335				
		9 p. m	784	.390	55.4	55.5	.304				
		9 p. m	790	.376	55	55.5	.333				
Do	Feb. 9	7 a. m	784	.422	42.5	42.5	.313				
		7 a. m	790	.390	42.5	42.5	.334	28.316			
Station A	do	9 a. m	784	28.490	60.5	63	28.335				
Camp 117	do	12 m	784	28.526	77.5	79.8	28.345				
		3 p. m	784	.474	76.1	77	.370				
		3 p. m	790	.470	78	77	.404				
		5 p. m	784	.441	63.2	63.5	.375				
		5 p. m	790	.433	63.6	63.5	.410				
		9 p. m	784	.438	43.5	44.9	.382				
		9 p. m	790	.436	44	44.9	.420				
Do	Feb. 10	7 a. m	784	.446	42	42.9	.348				
		7 a. m	790	.420	41.5	42.9	.368				
		9 a. m	784	.500	55	55	.358	28.478			
Station A	do	12 m	784	28.545	71	70.6	28.381				
Camp 118	do	3 p. m	784	28.546	71.5	72	28.456				
		3 p. m	790	.542	71.5		.495				
		Sunset	790	.529	64.4		.500				
		Sunset	784	.540	65	65	.468				
		9 p. m	784	.558	63	64.9	.451				
		9 p. m	790	.534	63.5		.469				
Do	Feb. 11	Sunrise	790	.468	57.7		.373				
		Sunrise	784	.540	56.5	57.5	.405				
		9 a. m	784	.581	56	56.8	.437	28.664			
Station A	do	12 m	784	28.642	59	60	28.508				
Camp 119	do	3 p. m	784	28.650	56	57.2	28.596				
		3 p. m	790	.627	57.8		.613				
		Sunset	790	.592	57.2		.583				
		Sunset	784	.615	56	57	.566				
		9 p. m	784	.574	55	56.8	.487				
		9 p. m	790	.567	55		.523				
Do	Feb. 12	Sunrise	790	.598	48		.527				
		Sunrise	784	.604	47	49.8	.481				
		9 a. m	784	.678	63.6	69	.515				
		9 a. m	790	.660	63.8		.540	28.752			
Station A	do	12 m	784	28.728	72	69	28.560				
Camp 120	do	3 p. m	784	28.750	71.5	72	28.657				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 120	Feb. 12	Sunset	784	28.736	64	64.7	28.667				
		Sunset	790	.692	67.5		.657				
		9 p. m	790	.700	56		.654				
		9 p. m	784	.746	57	56.5	.654				
Do	Feb. 13	Sunrise	784	.750	32.5	34	.677				
		Sunrise	790	.740	32.5		.700				
		9 a. m	784	.818	53.5	51	.681	28.795			
Station A	do	12 m	784	28.966	61.2	59.5	28.828				
Camp 121	do	3 p. m	784	28.982	62.3	62	28.911				
		3 p. m	783	29.008	62.3		.937				
		3 p. m	790	28.958	63		.928				
		Sunset	784	.966	58.5	59.5	.910				
		Sunset	783	.973	59.5		.913				
		Sunset	790	.954	58.5		.940				
Do	Feb. 14	Sunrise	783	29.074	40		.980				
		Sunrise	790	.042	40	40	.991				
		9 a. m	790	.074	53.7	54.9	.978				
		9 a. m	783	.116	50.8		.984				
		12 m	790	.016	62.8		.915				
		12 m	783	.072	59.6	64.5	.936				
		3 p. m	783	.026	61.5	63	.957				
		3 p. m	790	28.988	63		.958				
		Sunset	783	29.032	56	56	.982				
		Sunset	790	28.974	56		.967				
		9 p. m	790	29.026	50	50	.994				
Do	Feb. 15	Sunrise	790	.108	45	45.3	29.044				
		9 a. m	790	.146	53.8		.050				
		9 a. m	783	.188	49.3	53	.060	28.972			
Station A	do	12 m	783	29.289	58.5		29.155				
Station 7	do	3 p. m	783	29.262	66.2	61	29.181				
Camp 122	do	Sunset	783	29.266	62.3	59.5	29.194				
		9 p. m	783	.167	41.3	41.7	.115				
Do	Feb. 16	Sunrise	783	.046	41	41.4	28.964				
		9 a. m	783	.077	52	53.9	.942	29.086			
Station 2	do	12 m	783	29.024	63.7		28.876				
Camp 123	do	3 p. m	783	29.102	70.5	70	29.015				
		Sunset	783	.064	67		28.980				
		9 p. m	783	.040	51	54	.963				
Do	Feb. 17	Sunrise	783	.128	47.7	48.7	29.029				
		9 a. m	783	.122	60.5		.030				
		9 a. m	790	.142	58		.039	29.124			
Station B	do	12½ p. m	783	29.282	63.5		29.150				
Camp 124	do	3 p. m	783	29.303	55.2		29.249				
		9 p. m	783	.320	50.5		.279				
Do	Feb. 18	Sunrise	783	.286	45.6	46.5	.193	29.303			
Station A	do	9 a. m	783	29.510	54.5		29.368				
Camp 125	do	12 m	783	29.520	56.4	55.1	29.390				
		3 p. m	783	.560	54	53.7	.509				
		Sunset	783	.574	52.7	53.3	.526				
		9 p. m	783	.638	42.5	44.3	.582				
Do	Feb. 19	Sunrise	783	.656	30.5	31	.601	29.504			
Camp 126	do	Sunset	783	29.700	61.5	60.9	29.629				
		9 p. m	783	.660	45.5		.605				
Do*	Feb. 20	Sunrise	783	.684	38		.605	29.573		0	
Station A(1)	do	9 a. m	783	29.826	57.2		29.676				
Station C	do	12 m	783	29.839	64.6		29.688				
Station A(2)	do	3 p. m	783	29.796	68.5		29.705			0	Cirro cum., 3
Camp 127	do	Sunset	783	29.756	68.5		29.586			0	Cirrus, 1
		Sunset	790	.732	69		.683				
		9 p. m	783	.784	49.5		.708			0	
		9 p. m	790	.740	50.3		.707				

* Heavy fog during night; not entirely dispelled.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 127	Feb. 21	7 a. m	783	29.804	52.3	49.5	29.678		S	0.5	None
		7 a. m	790	.846	47.5		.670				
		9 a. m	783	.820	53.5		.680	29.622	S	0.5	Cirrus, 2
Station A	do	12 m	783	29.828	69.3		29.663			0	Cirro stratus, 6
Camp 128	do	3 p. m	783	29.790	71.7		29.693			0	Cirrus, 4
		Sunset*	783	.788	64.2		.709			0	Cir. cumulus, 9
		9 p. m	783	.786	57		.691		N.W	0.5	Cumulus, 3
Do	Feb. 22	Sunrise	783	.918	53.5		.798			0	None
		9 a. m	783	.936	54.5		.794	29.641			
Station 5	do	12 m	783	29.991	69.7		29.824			0	Cir. cumulus, 9
Camp 129	do	Sunset	783	29.800	61.3	61.7	29.729				
		Sunset	790	.774	64		.738		N.W	0.3	do
Do	Feb. 23	Sunrise	783	.750	41.3		.667				
		Sunrise	790	.696	41.2		.641			0	do
		8 a. m	783	.771	48.3		.650	29.601			
Station 7	do	12 m	783	29.780	70.6		29.612			0	Cir. cumulus, 1
Station 12†	do	3 p. m	783	29.474	71		29.378		S.W	1	Cir. cumulus, 7
Camp 130	do	Sunset	783	29.618	68.8		29.527			0	Cir. cumulus, 2
		9 p. m	783	.558	58.5		.461		S.W	0.8	Cirrus, 5
Do	Feb. 24	Sunrise	783	.590	55.6		.475		N.W	3	Cirro stratus, 1
		8 a. m	783	.640	62.7		.482	29.421		0	None
Station 3‡	do	12 m	783	29.556	61		29.417		N.W	4	None
Station 5	do	3 p. m	783	29.120	65.5		29.040		N.N.W.	3	None
Station 8	do	Sunset	783	29.642	65.2		29.562				
Camp 131	do	9 p. m	783	29.738	51.3		29.659		N.N.W.	1	None
Do	Feb. 25	Sunrise	783	.774	45.5		.680	29.608		0	None
Camp 132	do	9½ a.m.	783	29.866	58		.713				
		12 m	783	.856	64.6		.706				
		Sunset	783	.701	70	68	.607		S.W	3	Cirrus, 1
		9 p. m	783	.636	54.5	55.5	.550				
Do	Feb. 26	Sunrise	783	.582	36	37.5	.513				
		9 a. m	783	.664	59.5	62.3	.510	29.587			
Station A	do	12 m	783	29.710	66.2		29.554				
Camp 133§	do	3 p. m	783	29.676	72.7	71.2	29.577	29.580			
Camp 134§	Feb. 28	8¾ a. m	784	29.632	60.5		29.475				
		Sunset	784	.524	61.9		.453				
		9 p. m	784	.588	50		.512				
Do	March 1	Sunrise	784	.652	37.2		.580				
		9 a. m	784	.774	59.7		.618	29.595			
Camp 135	do	12 m	784	29.724	59.5		29.587				
		3 p. m	784	.746	61.2		.676				
		Sunset	784	.748	55.6		.694				
		9 p. m	784	.762	41.7		.707				
Do	March 2	Sunrise	784	.864	40.7		.792	29.586			
Station B	do	9 a. m	784	29.646	51		29.513				
Station 4	do	12 m	784	29.026	65.7		28.873				
Station D	do	3 p. m	784	28.508	60.5		28.444				
Camp 136	do	6.10 p. m	784	27.900	49.5		27.855				
		9 p. m	784	.890	44.5		.832				
Do	March 3	Sunrise	784	.856	43		.786	27.762			
Station 2	do	9 a. m	784	27.900	44.7		27.785				
Camp 137	do	12 m	784	27.372	69.3		27.216				
		3 p. m	784	.280	60.2		.220				
		Sunset	784	.264	54.7		.211				
		9 p. m	784	.216	44.6		.160				
Do	March 4	Sunrise	784	.150	40.7		.086	27.171			
Station B	do	9½ a. m	784	26.548	53.5		26.410				
Station F	do	12 m	784	26.342	59		26.212				
Station P	do	3 p. m	784	25.809	55		25.763				

* Appearance of rain. † Wind in gusts. ‡ In gusts.

§ Camps 133 and 134 were upon opposite sides of the river, at about the same height above the water. The mean of the barometric readings at the two places is taken to determine their altitude above the sea.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds
									Direction.	Force.	
	1854.										
Camp 138	March 4	Sunset	784	25.682	55.6		25.630				
		9 p. m	784	.684	47.8		.620				
Do	March 5	Sunrise	784	.596	38.2		.539	25.626			
Station D	do	9 a. m	784	25.286	46.2		25.172				
Camp 139	do	12 m	784	25.180	52.8		25.069				
		3 p. m	784	.146	52		.109				
		9 p. m	784	.106	37		.068				
Do	March 6	Sunrise	784	.064	31		.024	25.132			
Camp 140	do	9 p. m	784	26.031	35.5		25.997				
Do	March 7	Sunrise	784	.076	38.5		26.020	26.138			
Station D	do	9 a. m	784	26.416	45.5		26.302				
Station 9	do	12 m	784	26.204	54.5		26.088				
Station B	do	2.40 p. m	784	26.822	56		26.767				
Camp 141	do	Sunset	784	27.832	57.5		27.771				
		9 p. m	784	.814	55		.729				
Do	March 8	Sunrise	784	.831	49		.747	27.916			
Station D	do	9 a. m	784	28.702	55.5		28.558				
Station A	do	12 m	784	28.250	69		28.093				
Camp 142	do	Sunset	784	28.930	72.5		28.826				
		9 p. m	784	.888	46		.824				
Do	March 9	Sunrise	784	29.086	47		29.018	28.985			
Station D	do	9 a. m	784	29.133	69.7		28.951				
Camp 143	do	1½ p. m	784	28.894	85.5		28.774				
		3 p. m	784	.874	82.2		.752				
		Sunset	784	.860	68.5		.771				
		9 p. m	784	.872	56		.782				
Do	March 10	Sunrise	784	.838	44.6		.761	28.777			
Station O	do	9 a. m	784	28.732	58.7		28.579				
Station 6	do	12 m	784	28.580	84.7		28.380				
Station D	do	3 p. m	784	28.500	78.5		28.389				
Camp 144	do	Sunset	784	28.420	69.5		28.328				
Do	March 11	Sunrise	784	.333	47.6		.252	28.311			
Camp 145	do	Sunset	784	27.994	55		27.939				
	do	9 p. m	784	.988	47.5		.923				
Do	March 12	Sunrise	784	28.034	37.7		.976				
		9 a. m	784	.098	47.5		.978				
		12 m	784	.120	58.7		.988				
		3 p. m	784	.118	64.3		28.045				
		Sunset	784	.124	52.2		.076				
		9 p. m	784	.150	30.7		.125				
Do	March 13	Sunrise	784	.089	27		.056	28.064			
Station 1	do	8½ a. m	784	28.092	52.3		27.964				
Station 4	do	12 m	784	27.910	74.3		27.739				
Camp 146	do	Sunset	784	27.722	60						
Do	March 14	Sunrise	784	.776	29.8		27.759				
Station 5	do	8¾ a. m	784	27.782	49.3		27.657				
Station 8	do	12 m	784	27.632	66.5		27.481				
		3 p. m	784	.598	63		.529				
Camp 147	do	Sunset	784	27.434	51.5		27.389				
		9 p. m	784	.457	46.5		.394				
Do	March 15	Sunrise	784	.516	44		.444	27.459			
Station 4	do	10 a m	784	27.426	49.5		27.294				
Station 5	do	12 m	784	27.370	58.5		27.242				
		2¾ p. m	784	.362	62.5		.219				
Camp 148	do	9.40 p. m	784	27.113?	38.8						
Do	March 16	Sunrise	784	26.504	37.5			26.485			
Station 4	do		784	25.448	55.5		25.311				
Station 6	do	12 m	784	27.026	57		26.910				
Camp 149	do	Sunset	784	27.428	53.5		27.377				
		9 p. m	784	.426	43.7		.370				
Do	March 17	Sunrise	784	.424	42.6		.356				
		9 a. m	784	.442	50.7		.315				
		12 m	784	.410	44.7		.315				

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 149	March 17	3 p. m.	784	27.340	43.5		27.320				
		Sunset	784	.386	42.5		.364				
Do	March 18	Sunrise	784	.354	42		.287	27.407			
Station 1	do	9 a. m.	784	27.854	44		27.741				
Station 2	do	12 m.	784	27.882	45.5		27.784				
Station F	do	3 p. m.	784	28.472	47.5		28.440				
Camp 150	do	Sunset	784	28.670	47		28.635				
Do	March 19	Sunrise	784	.764	45		.688				
		9 a. m.	784	.838	66.7		.666				
		12 m.	784	.820	61.5		.681				
		3 p. m.	784	.798	52.2		.759				
		Sunset	784	.804	50.5		.760				
		9 p. m.	784	.818	47		.751				
Do	March 20	Sunrise	784	.788	37.5		.732	28.747			
Station D	do	9 a. m.	784	29.026	54.5		28.885				
Station 9	do	12 m.	784	29.274	67.6		29.117				
Station P	do	3 p. m.	784	29.472	65.5		29.391				
Station H	do	Sunset	784	29.754	57		29.689				
Camp 151	do	9 p. m.	784	29.824	47.5		29.755				
Do	March 21	Sunrise	784	.764	36.7		.708	29.777			
Station D	do	9 a. m.	784	29.798	62.3		29.634				
Camp 152	do	12 m.	784	29.710	68.2		29.549				
		12 m.	790	.670	65.7		.560				
		3 p. m.	784	.672	68.5		.583				
		3 p. m.	790	.642	67		.599				
		Sunset	784	.670	55		.611				
		Sunset	790	.638	52.2		.630				
		9. p m.	784	.708	49.5		.634				
		9 p. m.	790	.686	50		.653				
Do	March 22	Sunrise	784	.606	42		.536				
		Sunrise	790	.684	42		.657				
		9 a. m.	784	.826	65						
		9 a. m.	790	.782	62.5		.662				
		12 m.	784	.744	67		.586				
		12 m.	790	.720	67		.605				
		3 p. m.	784	.703	64.5		.624				
		3 p. m.	790	.683	63		.650				
		Sunset	784	.700	55.2		.641				
		Sunset	790	.672	56.1		.653				
		9 p. m.	784	.742	51.5		.664				
		9 p. m.	790	.721	50.9		.686	29.665			
Cp. 153, San Pedro	March 24	8 a. m.	784	30.030	68		29.855	29.925*			

* Abnormal variation for same date at San Francisco applied to this observation.

OBSERVATIONS—Continued.

NOTE.—The following pages of this Appendix comprise a portion of the meteorological observations that were taken by detached reconnoitring parties at different periods during the survey. A few of the more important observations made upon the main line, selected from a large number that were omitted at the first hasty preparation of the work, have been added to those referred to above.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Anton Chico+4 m.	Sept. 29	10 a. m	785	24.531	70.5	20 c	24.452				
Do +12 m.	do	12 m	785	.233	72.9	22.8c	.176				
Valley at La Cuesta	do	5.30 p. m	785	24.432	71.8	21.9c	24.449				
Top of bluff at La Cuesta.	do	6 p. m	785	23.984	67.5	18 c	24.007				
Do	Sept. 30	6 a. m	785	24.038	52.6	10.8c	.012				
Station 5	Oct. 1	11 a. m	785	23.724	55	14.2c	23.563				
Station 6	do	12.30 p. m	785	23.973	60.4	16.8c	23.882				
Station 7	do	1 p. m	785	24.036	66.5	19.4c	23.912				
Valley of Rio Galisteo.	do	2.30 p. m	785	24.177	65.4	20 c	24.099				
Galisteo	do	Sunset	785	24.420	54.8	11.7c	24.364				
Do	Oct. 2	Sunrise	785	.454	34	0.8c	.337				
		10.30 a. m	785	.426	73	18.6c	.256				
Las Cerritas	do	6.30 p. m	785	24.472	52.5	10.7c	24.439				
Do	Oct. 3	Sunrise	785	.450	34	—0.5c	.396				
Peña Blanca	do	2 p. m	785	25.112	76.5	25 c	24.954			0	Cirro-cumulus.
Mouth of Rio Galisteo.	do	3.30 p. m	785	25.136	75.2	22.5c	24.995			0	Cirro-cumulus.
Santo Domingo	do	7 p. m	785	25.141	60.2	15.5c	25.014		E	1	Cirro-cumulus.
Do	Oct. 4	Sunrise	785	.149	40.5	4.5c	.072			0	None
San Felipe	do	11 a. m	785	25.208	75.8	30.6c	25.012			0	Cirrus
Top of bluff near San Felipe.	do	11 a. m	785	25.087	78.4	30.6c	24.886			0	Cirrus
Zandia	do	Sunset	785	25.234	66	18.9c	25.165		N.E	1	
Do	Oct. 5	Sunrise	785	.261	53.5	9 c	.171		N.E	1	Stratus
Camp 61, Isleta	Oct. 29	12 m	783	25.599	61		25.479		N.E	1	Cirrus, 1
Do	do	Sunset	783	.522	56.3		.470				
Sta. 1, near Camp 60′, in valley of Rio Grande.	Nov. 11	10.15 a. m	784	25.150	59		24.998				
Station 2	do	10.30 a. m	784	25.105	67		24.932				
Station 3	do		784	24.636	68		24.456				
Station 4	do		784	24.446	68		24.302				
Station 5	do		784	24.345	69		24.241				
Station 7	do	2.15 p. m	784	24.291	67.5		24.211				
Station 8	do		784	24.230	66.5		24.166				
Camp 61′, Rio Puerco.	do	Sunset	784	24.790	64		24.723				
Do	Nov. 12		784	25.062	67		.902				
Station 1	do		784	24.980	64		24.827				
Station 2	do		784	24.936	65		24.780				
Station 4	do		784	25.030	71		24.881				
Station 6	do		784	24.846	68		24.704				
Camp 62[1], El Alamo	do		784	24.800	69		24.726				
Do	Nov. 13	8.30 a. m	784	.720	41		.620				
Station 15	do		784	23.972	76		23.886				
Station 16, Laguna	do		784	24.465	71		24.390				
Camp 63′	Nov. 14		784	24.436	58		24.384				
Camp 82	Dec. 13	Sunrise	785	25.062	30	30.8	24.950		N	5	Cumulus, 3
Sta. 1, 3½ miles W.	do	11.45 a. m.	783	25.000	60		24.858				

September 30.—Weather variable; storm of rain at night.
October 1.—11 a. m., the long storm over, and the day pleasant; evening mild and the sky cloudless.
October 2.—The day and night beautifully clear and calm.
October 3.—Sunrise, weather clear and calm.
October 29.—Sunset, calm and clear.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Station 3	Dec. 13	3.25 p. m.	783	24.808	53		24.787				
Bivouac 1	Dec. 14	Sunrise	783	24.616	30.3		24.556				
Bivouac 2, mouth of Cañon Diablo.	Dec. 15	Sunrise	783	25.085	22		25.038				Cirrus, 3
Station B	do	12.30 p. m.	783	24.754	34.5		24.710				
		1.30 p. m.	783	.826	47.5		.788				Nim. & cum., 9
Bivouac 3	do	Sunset	783	24.386	34.4		24.387				
Do	Dec. 16	Sunrise	783	.480	13.7						
		9 a. m	783	.497	26		.441				
Station 3, top of volcanic peak.	do		783	23.858	45		23.754				
Station 4—valley	do	10.30 a. m.	783	24.320	37.5		24.230				Cirrus, 1
Bivouac 4	do	1.50 p. m.	783	23.586	40		23.570		N.W.	1	Cir.-cum., 2
		Sunset	783	.574	34.5						Cirrus, 1
Do	Dec. 17	Sunrise	783	.591	29.6		.588				
Station 1	do	10.10 a. m.	783	23.389	44.7		23.287				
Station B	do	11 a. m	783	23.222	44.2		23.108				
Station C	do		783	23.330	48.3		23.146				
Station 8	do		783	22.486	55.2		22.452				
Biv. 5, Leroux's Sp.	do		783	22.920	54.7		22.881				
		Sunset	783	.900	36.5		.894				
Do	Dec. 18	Sunrise	783	.835	*21.7		.795				Cirro-strat., 2
Station 4	do	3 p. m	783	23.180	47.5		23.159				
Bivouac 6	do	Sunset	783	23.107	39.7		23.100		N.E.	3	Cirrus, 2
Do	Dec. 19	Sunrise	783	.092	40.3		.014		S.E.	1	Stratus, 9
Bivouac 7, Cosnino caves.	do	Sunset	783	23.926	32.5		23.942				Cirrus, 7
Do	Dec. 20	Sunrise	783	.913	31.3		.896		W.S.W.	2	Cirro-strat., 2
Camp 87	do	Sunset	783	25.330	45.5		25.396			0	Cir.-cum., 5
Camp 91, Leroux's Spring.	Dec. 28	9 a m	783	23.062	46.8		22.964			0	Cirrus, 3
Top of Hill D	do	11.50 a. m.	783	22.141	48.7		22.051				
		1.30 p. m.	783	.113	44.7		.090				
Base of Hill D	do	2.30 p. m.	783	22.846	56.7		22.814				
Leroux's Spring	do	3 p. m	783	22.964			22.952				
Do	Dec. 30	9.35 a. m.	783	.988	32.5		.902		W.	1.5	
Bivouac 1[1]	do	Sunset	783	22.977	32.6		22.986			0	
Do	Dec. 31	Sunrise	783	.938	27		.917				
		9.30 a. m.	783	23.116	51.5		.993		S.	2	Cirrus, 1
Station 2	do		783	23.113	49.8		22.977				

* The thermometer at the river indicated colder weather in the valley than was found 2,000 feet higher among the mountains, being at this time 8°.5 Fahrenheit. The reverse occurs during the middle of the day, it being the warmer in the valley, showing that the thermometer has a less daily range in the mountains than in the lowlands. The high gravelly mesas and ridges probably absorb more heat by day and radiate more at night than do the clayey bottom lands.

December 14.—At 7.30 p. m., a bright coronæ of variegated colors encircled the moon; slight snow at 8 p. m.; cumulus clouds at 8.30; appearance of more snow.

December 15.—The morning clear and calm, the San Francisco mountains being free from clouds and clad in snow; soon they were crowned in mist, which spread and quickly brought a snow-storm; shortly this passed over and was succeeded by several similar phenomena; an inch of snow fell during the day. In the evening, clouds that had heretofore travelled eastward, were flying towards the southwest, and at 9.30 p. m. not a vestige of them could be seen, excepting a fringed bank which rested upon the loftiest of the mountains in front; at 8 p. m. bright coronæ around moon; the atmosphere beautifully serene and brilliant.

December 16.—At 9 a. m., hazy. At 9 p. m., light green halo around moon.

December 17.—At sunrise a breeze came from the east, and the atmosphere was pure and transparent; the day fine; the sun warm enough to effect a slight depression of the snow, which lies upon the hills and valleys to a depth of about eight inches. Clear during the day.

December 18.—The sky before sunrise was variegated with cirro-stratus clouds, producing an imperfect halo, 22° diam. around the moon; ice an inch thick covered the rivulet in the valley. The spring itself was not frozen; at 12 m., clouds, cirrus 7; wind southeast, 5; at 1 p. m, wind west, 5; clouds moving north 60° east. The sun during the day dimmed with cirrus clouds; the night clear. Sunset, clouds moving southeast; night clear.

December 19.—The evening calm and clear.

December 20.—Sunrise, clouds moving east.

December 28.—The day clear and pleasant; the night somewhat cloudy, threatening rain.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1853.										
Bivouac 2[1], New Year's Spring.	Dec. 31	3 p. m.	783	23.479	52.3		23.447		W.	1	Cirrus, 2
		7.30 p. m.	783	.455	32.7		.442				
	1854.	9 p. m.	783	.467	32.5		.441			0	
Do	Jan. 1	Sunrise	783	.497	34.5		.462			0	Cirrus, 2
		9 a. m.	783	.528	38.2		.434				
Bivouac 3[1]	do	Sunset	783	23.702			23.693				
Do	Jan 2	Sunrise	783	.723	26.5		.674			0	Stratus, 4
		9.40 a. m.	783	.897	42.6		.788				
Station 1	do		783	23.690	53.6		23.551				
Station 7	do	1.07 p. m.	783	23.874	58.7		23.797				
Station B—valley.	do	1.30 p. m.	783	23.934	58.7		23.869				
Bivouac 4[1]	do	3 p. m.	783	24.104	59.3		24.055				
		Sunset	783	.048	44		.026				
Do	Jan. 3	Sunrise	783	.004	38.3		23.930				
		9 a. m.	783	.040	48.8		.922				
Station 3	do	3 p. m.	783	25.008	69.8		24.931				
Bivouac 5[1]	do		783	25.046	68.5		24.984				
		Sunset	783	.006	52.3		.964		E	5	
Do	Jan. 4	Sunrise	783	24.898	23.5		.856		N.E	2	Stratus, 3
		9.15 a. m.	783	.915	47.4		.800		N.E	2	Stratus, 5
Station 2	do	11.30 a. m.	783	24.953	55.5		24.820		N.E.	1	Stratus, 6
Bivouac 6[1]	do	4.10 p. m.	783	24.454	54.8		24.423				Stratus, 6
Do	Jan. 5	Sunrise	783	.426	37.6		.353		S.E.	4	Stratus, 6
		8.50 a. m.	783	.415	39.5		.317		S.E.	4	Nimbus, 9
Station 1	do		783	24.167	38.5		24.090				
Bivouac 7[1]	do	4 p. m.	783	23.584	48.3		23.569		S.E.	2	Nimbus, 9
Do	Jan. 6	Sunrise	783	.584	29		.595		N.E	4	Nimbus, 10
Camp 94, New Year's Spring.	do	3 p. m.	783	23.496	38		23.492		N.E	2	Nimbus, 10
Camp 97	Jan. 11	11.15 a. m.	783	25.020	47.3		24.895			0	Cirro-cum., 7
Bivouac 1[2]	do	3.25 p. m.	783	25.082	55.5		25.044			0	Cirro-cum., 7
		Sunset	783	.061	41.7		.044			0	Cirro-cum., 4
Do	Jan. 12	Sunrise	783	24.908	14.5		24.886			0	Cirrus, 2
		9 a. m.	783	.970	38.4		.875			0	Nimbus, 6
Bivouac 2[2]	do	3 p. m.	783	25.034	66.8		.966			0	
		Sunset	783	.172	49.8				N.N.W.	5	
Do	Jan. 13	Sunrise	783	24.957	27.5		.906			0	Cirro-stratus, 5
		10.10 a. m.	783	25.071	52.5		.936		S.	1	Cirrus, 1
Station 6	do	3 p. m.	783	25.187	67.5		25.117				
Bivouac 3[2]	do	3.55 p. m.	783	25.072	57.8		25.024			0	Nimbus, 9
Do	Jan. 14	Sunrise	783	24.966	31.5		24.906		N.E	3	Nimbus, 8
Bivouac 4[2]	do	12.40 p. m.	783	24.514	50.5		24.438		S.	4	Nimbus, 10
		Sunset	783	.492	48		.460		S.	2	Nimbus, 10
Do	Jan. 15	Sunrise	783	.362	24.8		.318		S.	2	Cirro-cum., 3
		8.35 a. m.	783	.444	28.3		.371		N.E	1	Cirro-cum., 1
Camp 99	do	3 p. m.	783	25.016	55.5		24.972		S.E.	2	Cirro-cum., 5

January 1.—The day warm; the night somewhat hazy.

January 2.—The day and night calm and clear.

January 3.—The day pleasant; the evening mild and clear, with a light air from the east.

January 4.—Cold wind at sunrise; light stratus clouds near horizon; the day pleasant and the wind mild; stratus clouds banding the sky.

January 5.—Sunrise, the day commenced with gusts of wind from the southeast and with stratus clouds, which soon spread unto nimbus; and after midday, storms of snow covered the higher mountain tops. The clouds broke away towards evening just sufficiently to form a gorgeous suuset, casting a lurid hue over the landscape.

January 6.—At sunrise and during the morning, there was a driving sleet. The clouds disappeared at sunset, but the misty blasts continued to blow from the northeast. The peaks of San Francisco, now visible, are again white with snow.

January 11.—At 9 p. m., clouds, cirrus, 5; halo around moon 22° diam.; no wind.

January 14.—As the moon approached the horizon, nimbus clouds rose from the S.W., and passiug rapidly towards the N.E., soon covered the sky. At the same time a stiff breeze blew from the N.E., showing an upper and lower current in opposite directions. The day was cloudy, with strong wind from the south, which at night brought hail, rain, and a little snow.

January 15.—Sunrise, sky clear; a cold breeze blowing; clouds passing towards the east.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Camp 99	Jan. 16	9 a. m	783	25.120	36.7		25.009		S.E.	1	Cirro-cum., 2
Bivouac 1[3]	do	Sunset	783	24.734	35.7		24.731		S.W	3	Nimbus, 6
Do	Jan. 17	Sunrise	783	.842	26.5		.794				
		7.55 a. m	783	.834	33		.754				
Bivouac 2[3]	do	3.30 p. m	783	24.598	40		24.594				
Do	Jan. 18	Sunrise	783	.531	24.5		.487				
Bivouac 3[3]	do	Sunset	783	24.036	34.3		24.037			0	Cumulus, 9
Do	Jan. 19	Sunrise	783	23.768	33		23.704				
		9 a. m	783	.776	33.5		.692		S.W		Cumulus, 9
N.W. of summit Aztec Pass.	do	12.30 p. m.	783	23.932	49		23.876				
Summit Aztec Pass	do	4 p. m	783	23.590	29.5		23.604				
Bivouac 4[3]	do	Sunset	783	24.126	30.5		24.134		W.S.W.	3	Cumulus, 3
Do	Jan. 20	Sunrise	783	.344	13		.321		N.W	3	
		9 a. m	783	.416	18.6		.365		W	3	
Bivouac 5[3], Camp 103.	do	12.40 p. m.	783	24.926	21		24.928		N	1	
		Sunset	783	.917	13.6		.962				
Do	Jan. 21	Sunrise	783	.860	— 1.5		.872			0	
		9 a. m	783	25.032	21.5		.975				
Do	Jan. 22	10 a. m	783	.123	37.5		25.021				
Station A	do	10.20 a. m.	783	25.100	42.9		24.981				
Station 3	do	10.50 a. m.	783	25.037	43.8		24.913				
Station B	do	11 a. m	783	25.013	46.2		24.880				
Station C	do	11.50 a. m.	783	24.946	47.7		24.841			0	Cirrus, 3
Station 12	do	1.10 p. m.	783	24.750	48.3		24.692				
Station D	do	1.25 p. m.	783	24.742	49.5		24.693				
Station E	do	1.48 p. m.	783	24.617	46.5		24.530				
Station F	do	2 p. m	783	24.645	46.2		24.613				
Station 14	do	3 p. m	783	24.556	45.5		24.536			0	Cirro-cum., 9
Station 15	do	4 p. m	783	24.424	42.2		24.420				
Station H	do	4.20 p. m.	783	24.546	43		24.530				
Station K	do	4.30 p. m.	783	24.502	44.5		24.496				
Station 17	do	Sunset	783	24.528	45.5		24.503				
Camp 104	do	6 p. m	783	24.561	40.5		24.542			0	Cirro-cum., 6
Do	Jan. 23	9.45 a. m.	783	.477	44.9		.354				
Station A	do	10 a. m	783	24.441	48.5		24.317				
Station B	do	10.20 a. m.	783	24.511	50.8		24.370				
Station 2	do	10.40 a. m.	783	24.458	50.9		24.317				
Station 5	do	11.15 a. m.	783	24.206	51.5		24.084				
Summit Aztec Pass	do	12 m.	783	24.176	55.6		24.063				
Station 6, side of mountain.	do	12 m.	cis.	23.957	55		23.850		E.	1	Cumulus, 8
Station 7	do	12.15 p. m	cis.	24.110	55		24.004				
Station 8	do	12.40 p. m.	784	24.235	56.8		24.145				
		12.40 p. m.	cis.	.167	56.5						
Station 9	do	1.10 p. m.	cis.	24.224	56		24.153				
Camp 105	do	2.30 p. m.	cis.	24.428	53.5		24.386				
Do	Jan. 24	9 a. m	784	.429	50.8	50	.308		E.	0.1	Cirro-cum., 8
Station A	do	10 a. m	784	24.429	51.5		24.299		E.	2	Cirro-cum., 7
Station B	do	11.10 a. m	cis.	24.564	52		24.461				
Station D	do	12 m.	cis.	24.668	53.2	53.7	24.601		S.E	0.2	Cirro-cum., 5

January 16.—Three or four inches of snow fell last night; morning clear and calm. At 10 a. m., wind rose from the south, followed by a storm of sleet. At noon sleet ceased falling; wind blew from the southwest till sunset; afterwards coming in gusts.

January 22.—At sunrise, cirrus clouds covered the sky, but soon disappeared; the day was clear and without wind.

January 23.—10.40 a. m., cirrus clouds again appeared, with a light breeze from the east. The day was warm, with an easterly breeze. Light cirrus clouds frequently formed, changed into cumulus, and disappeared. In the evening, there was the same variable sky. A few stars occasionally appeared for a moment, and were soon again veiled in mist. At 9 p. m., the atmosphere became saturated with moisture, and distilled a few drops of rain.

January 24.—Cirro-cumulus clouds were floating in the sky during the day. The breeze, at night, gathered strength and threatened a storm, although the clouds disappeared.

OBSERVATIONS—Continued.

Station.	Date.	Hour.	No. of barometer.	First reading.	Attached thermometer.	Air thermometer.	Reading corr. for constant error, temp. and hor. variation.	Corrected mean barometer reading.	Wind.		Clouds.
									Direction.	Force.	
	1854.										
Station 4	Jan. 24	12.25 p. m.	cis.	24.707	53.5		24.652				
Camp 106	----do----	1.30 p. m.	cis.	24.756	56.7		24.735				
Do	Jan. 25	10.15 a. m.	783	.710	48		.586				
Bivouac 1[4]	----do----	4.30 p. m.	783	25.036	44.7		24.967				
Do	Jan. 26	Sunrise	783	.162	25		25.116			0	Cumulus, 9
		9.10 a. m.	783	.249	36.7		.155			0	
Station 9, in cañon	----do----	1.50 p. m.	783	25.644	43.5		25.617				
Station 10, top of cañon.	----do----	2 p. m.	783	25.362	56.5		25.302				
Bivouac 2	----do----	3.50 p. m.	783	25.388	45.3		25.377				
		Sunset	783	.394	38.7		.384		N. E.	0.2	
Do	Jan. 27	Sunrise	783	.499	28.5		.446		N. E.	0.2	
		9 a. m.	783	.558	37.6		.465		N. E.	1	
Station 2	----do----		783	24.799	53.5		24.689				
Bivouac 3[4]	----do----	Sunset	783	25.902	53.7		25.856			0	Cirrus, 3
Do	Jan. 28	Sunrise	783	.747	37.7		.674			0	Cirrus, 3
		9 a. m.	783	.776	48.8		.657			0	Cirrus, 5
Station 5	----do----	2 p. m.	783	26.634	73.7		26.535				
Bivouac 4[4]	----do----	Sunset	783	26.092	57.5		26.037		N	0.5	Cumulus, 5
Do	Jan. 29	Sunrise	783	.062	39.3		25.984			0	Cirrus-strat., 8
		9.15 a. m.	783	.124	57.8		.984				
Bivouac 5[4], Cactus Pass.	----do----	1.15 p. m.	783	25.094	78.5		24.982				
		Sunset	783	.026	47.8		.986		N. N. E.	0.5	Cirrus, 2
Do	Jan. 30	Sunrise	783	.022	39.8		.944		N. N. E.	0.5	Cirrus, 2
		9 a. m.	783	.082	48.3		.964		N. N. W.	1	Cirrus, 1
		3 p. m.	783	.060	68.2		.988		E.	3	Cirrus, 1
		Sunset	783	.022	49		.987		E.	0.5	Cirrus, 4
Do	Jan. 31	Sunrise	783	24.950	45.3		.860			0	
		9 a. m.	783	.983	55.8		.851		E. N. E.	2	
Do	Feb. 1	Sunrise	783	.788	45.8		.697			0	
		10.15 a. m.	783	.782	61.7		.627			0	
Big Horn Spring	Feb. 3	11.19 a. m.	783	27.056	71.5		26.859				
Bivouac 2	----do----	3.15 p. m.	783	27.630	73.1		27.536				
		Sunset	783	.622	65.5		.541			0	Cirro-cum., 8
Do	Feb. 4	Sunrise	783	.575	43.3		.485		W.	0.8	Cirro-cum., 8
		9 a. m.	783	.622	56.5		.480		W.	1	Cirrus, 7

January 25.—A cloudy sky and a raw south wind produced a chilly day. From sunset to 9 p. m., there was a slight rain, followed by a light fall of snow.

January 26.—The morning was cloudless. A light air came from the east, attended, as usual, by a dry atmosphere and a deep blue sky. There was a storm last night, which spread over the ground a thin coat of snow. The wind had shifted from south to S.W. The day cloudless, with wind from the north; the evening also clear, and a light breeze blowing from the N.E. The atmosphere beautifully transparent, and the stars brighter than usual.

January 29.—At sunrise, cirro-stratus clouds stretched from the east to the west. The sky soon became clear, and the thermometer, at mid-day, rose to 78°. 5. Towards evening there was a breeze from the east.

January 30.—9 a. m., smoky atmosphere.

APPENDIX K.

TABLES OF INSTRUMENTAL ERRORS AND HORARY CORRECTIONS

to be applied to the Barometric Observations; with Climatological Remarks, and Chart.

PREPARED BY Mr. LORIN BLODGET.

[Note.—This appendix exhibits the plan pursued in the first reduction of the barometric observations, when it was necessary to present, without delay, a profile to accompany the preliminary report. Since then, this subject has undergone revision; and the system followed by Mr. Blodget has been replaced by another, which will be found described in the topographical report. The elements for horary variation remain unchanged.]

Determination of elements for the reduction of barometric observations for heights.—Remarks upon the value of the observations.—Curves of daily oscillation of barometric column in New Mexico.—Report and chart of climatological investigations.

The direction given to the barometric reductions of the survey, (made by Lieutenant Whipple, topographical engineers, for a railroad route near the 35th parallel,) differs somewhat from that usual to these observations, and the following notes and explanations of the processes may be necessary. The large number of barometric observations made, and the general accuracy and uniform comparison retained throughout the survey, by the instruments employed, render the observations of this extended line unusually important and valuable. Determinations made by them are almost the best possible by this mode of survey, and for this reason great care was required, and was given, to their reduction.*

The first series of observations made with the barometers at Cincinnati, Little Rock, and Fort Smith, were employed to determine positive comparisons of the instruments among themselves, those given by the maker not being found correct after transportation. The best results that could then be determined for zero error were obtained from these, and from comparisons with other barometers. The relative position of the instruments, as thus determined, was found to be the same at Albuquerque and at the termination of the survey; and the slight zero error possibly remaining, in the absence of opportunity to compare anew with an absolute standard, would be unimportant.

The observations at Cincinnati, Napoleon, Little Rock, and Fort Smith, are given in full, to show the comparison of the instruments. The column headed *difference*, gives the measure of variations of each instrument from the cistern barometer, No. 790. By full comparison, this last was considered too low by .019 of an inch, and the differences here given should be diminished by this quantity, to be regarded as comparisons with the standard ultimately assumed. The original comparisons of the maker, and the corrections as finally determined and applied, follow:

* The barometric observations of the Pacific railroad route near the 35th parallel, under the direction of Lieutenant Whipple, were reduced in a manner somewhat different from the usual course, and the following notes and explanations of the processes may be necessary. The number of these observations was unusually great at each of the camps and important points, and the instruments proved to be of the best character, and to have retained a uniform comparison among themselves throughout. Determinations from so large a number of good observations are almost the best possible in barometric survey, and for this reason great care was given to their reduction.

APPENDIX K—Continued.

BAROMETER No. 781.

Date.	Time.	Upper vernier.	Lower vernier.	Cor. height.	Difference.
Burnet House, Cincinnati.					
June 13	10½ a. m.	30.938	1.064	29.874	+.057
13	12½ p. m.	.931	.071	.860	
13	5½ p. m.	.885	.118	.767	+.049
13	9 p. m.	.894	.125	.769	
14	10 a. m.	.888	.100	.788	+.030
14	12 m.	.889	.116	.773	+.042
Arkansas Hotel, Napoleon, Ark.					
June 23	8 p. m.	31.092	0.913	30.179	
24	10 a. m.	.150	.850	.300	
Anthony House, Little Rock.					
June 27	8¾ a. m.	30.408	0.424	29.966	+.038
27	12½ p. m.	31.007	1.041	.966	+.056
27	6 p. m.	30.980	.074	.906	+.059
27	9¾ p. m.	.955	.076	.879	+.049
28	7 a. m.	.983	.052	.931	
28	10¾ a. m.	.997	.044	.953	+.040
28	6½ p. m.	.965	.090	.875	+.048
28	Midnight.	.938	.079	.859	+.034
29	7⅓ a. m.	.966	.067	.899	+.045
29	11½ a. m.	.987	.068	.919	+.037
Rogers' Hotel, Fort Smith.					
4	1½ p. m.	30.917	1.162	29,755	+.047
4	4¾ p. m.	.915	.167	.748	+.057
5	8.35 a. m.	.966	.143	.823	+.054
5	12.19 p. m	.958	.150	.808	+.048
5	10¼ p. m.	.940	.157	.783	+.050
6	8⅓ a. m.	.976	.133	.843	+.056
6	2 p. m.	.955	.160	.790	+.056
6	9 p. m.	.951	.119	.832	+.040
7	9½ a. m.	.986	.119	.867	+.055
7	12¼ p. m.	.982	.145	.837	+.051
7	3¼ p. m.	.969	.150	.819	+.064
7	6.10 p. m.	.970	.157	.813	+.043
8	3¼ p. m.	.969	.186	.783	+.047
8	6¼ p. m.	.938	.160	.778	
9	9 a. m.	.964	.134	.830	+.063
9	12 m.	31.390	.600	.790	+.047
9	3 p. m.	30.931	.170	.761	+.058
9	5¾ p. m.	.916	.171	.745	+.046
11	9½ a. m.	.932	.162	.770	+.052
11	12 m.	.928	.171	.757	+.047
11	2½ p. m.	.997	.188	.709	+.059
11	6 p. m.	.890	.188	.692	+.054
12	8½ a. m.	.953	.198	.755	+.059

BAROMETER No. 783.

Date.	Time.	Upper vernier.	Lower vernier.	Cor. height.	Difference.
Burnet House, Cincinnati.					
June 13	10½ a. m.	31.155	1.291	29.864	+.047
13	12½ p. m.	.154	.300	.854	+.058
13	5½ p. m.	.107	.342	.765	+.047
13	9 p. m.	.114	.336	.778	
14	10 a. m.	.106	.323	.783	
14	12 m.	.111	.333	.778	+.047
Arkansas Hotel, Napoleon.					
June 24	11 a. m.	31.375	1.092	30.283	+.033
Anthony House, Little Rock.					
June 27	8¾ a. m.	31.230	1.264	29.966	+.038
27	12½ p. m.	.236	.279	.957	+.047
27	6 p. m.	.200	.300	.900	+.053
27	9¾ p. m.	.174	.300	.874	+.044
28	7 a. m.	.177	.278	.899	
28	10¾ a. m.	.212	.272	.950	+.047
28	6½ p. m.	.175	.299	.876	+.039
28	Midnight.	.150	.291	.859	+.034
29	7.20 a. m.	.161	.280	.881	
29	11½ a. m.	.188	.271	.917	+.035
Rogers' Hotel, Fort Smith.					
July 4	1½ p. m.	31.113	1.369	29.744	+.036
4	4¾ p. m.	.098	.367	.731	+.040
5	8.35 a. m.	.122	.313	.809	+.032
8	9½ a. m.	.169	.286	.883	+.048
8	3¼ p. m.	.117	.338	.779	+.043
8	6¼ p. m.	.092	.330	.762	+.046
9	9 a. m.	.115	.310	.805	+.038
9	12 m.	.107	.316	.791	+.038
9	3 p. m.	.188	.442	.746	+.043
9	5¾ p. m.	.078	.335	.743	+.044
10	9½ a. m.	.096	.328	.768	+.060
10	12 m.	.090	.335	.755	+.045
11	2½ p. m.	.064	.368	.696	+.046
11	6 p. m.	.050	.369	.681	+.043
12	9 a. m.	.081	.333	.748	+.052
12	12½ p. m.	.081	.344	.737	+.047

BAROMETER No. 784.

Burnet House, Cincinnati.					
June 13	10½ a. m.	31.452	1.586	29.866	+.043
13	12½ p. m.	.449	.559	.890	
13	5½ p. m.	.404	.644	.760	+.042
13	9 p. m.	.406	.638	.768	
14	10 a. m.	.410	.626	.784	
14	12 m.	.410	.636	.774	+.041

APPENDIX K—Continued.

BAROMETER No. 784—Continued.

Date.	Time.	Upper vernier.	Lower vernier.	Cor. height.	Difference.
Arkansas Hotel, Napoleon.					
June 24	11 a. m	31.519	1.228	30.291	+.039
Anthony House, Little Rock.					
June 27	8¾ a. m	31.330	1.366	29.964	+.036
27	12½ p. m.	.333	.380	.953	+.043
27	6 p. m	.304	.416	.888	+.041
27	9¾ p. m	.280	.419	.861	+.031
28	7 a. m	.307	.383	.924	
28	10¾ a. m	.331	.377	.954	+.041
28	6½ p. m	.281	.421	.860	+.033
28	Midnight.	.263	.416	.847	
29	7.20 a. m.	.280	.397	.883	
29	11½ a. m.	.306	.391	.915	+.032
Rogers' Hotel, Fort Smith.					
July 4	1½ p. m	31.188	1.435	29.753	+.045
4	4¾ p. m	.177	.436	.741	+.050
5	8.35 a. m.	.430	.614	.816	+.047
5	12.19 p. m	.419	.617	.802	+.042
5	10¼ p. m.	.410	.628	.782	+.039
6	8¼ a. m	.423	.595	.828	+.041
6	2 p. m	.402	.628	.774	+.040
6	9 p. m	.434	.588	.846	+.054
7	9½ a. m	.432	.572	.860	+.048
7	12¼ p. m.	.428	.583	.845	+.059
7	3¼ p. m	.418	.600	.818	+.065
7	6.10 p. m.	.409	.590	.819	+.049
8	9½ a. m	.446	.554	.892	+.057
8	3¼ p. m	.400	.614	.786	+.050
8	6¼ p. m	.383	.608	.775	+.059
9	9 a. m	.394	.579	.815	+.048
9	12 m	30.950	.154	.896	
9	3 p. m	31.370	.611	.759	+.056
9	5¾ p. m	.360	.623	.737	+.038
11	9½ a. m	.359	.608	.751	+.033
11	12 m	.339	.672	.667	
11	2½ p. m	.340	.660	.688	+.038
11	6 p. m	.339	.661	.779	
12	9 a. m	.350	.630	.720	+.024
12	12½ p. m.	.360	.636	.724	+.034

BAROMETER No. 785.

Date.	Time.	Upper vernier.	Lower vernier.	Cor. height.	Difference.
Burnet House, Cincinnati.					
June 13	10½ a. m.	31.153	1.300	29.853	+0.36
13	12½ p. m.	.150	.310	.840	+0.44
13	5½ p. m.	.102	.350	.752	+0.34
13	9 p. m	.102	.336	.766	------
14	10 a. m.	.100	.328	.772	------
14	12 m	.101	.336	.765	+0.33
Arkansas Hotel, Napoleon.					
June 24	11 a. m.	31.340	1.112	30.278	+0.28
Anthony House, Little Rock.					
June 27	8¾ a. m.	31.215	1.258	29.957	+0.29
27	12½ p. m.	.219	.277	.942	+0.32
27	6 p. m	.188	.308	.880	+0.33
27	9¾ p. m.	.165	.304	.859	+0.29
28	7 a. m	.188	.272	.916	------
28	10¾ a. m.	.206	.277	.929	------
28	6½ p. m.	.161	.301	.860	+0.33
28	Midnight.	.142	.293	.849	+0.24
29	7½ a. m.	.153	.279	.876	+0.21
29	11½ a. m.	.169	.261	.908	+0.26
Rogers' Hotel, Fort Smith.					
July 4	1½ p. m.	31.112	1.378	29.734	+0.26
4	4¾ p. m.	.104	.379	.725	+0.34
5	8.35 a. m.	.129	.332	.797	+0.28
5	12.19 p. m	.123	.336	.787	+0.27
5	10.15 p. m	.100	.345	.755	+0.22
6	8½ a. m.	.128	.314	.814	+0.27
6	2 p. m.	.129	.368	.761	+0.27
6	9 p. m.	.180	.357	.823	+0.31
7	9½ a. m.	.138	.296	.842	+0.30
7	12¼ p. m.	.130	.308	.822	+0.36
7	3¼ p. m.	.118	.327	.791	+0.36
7	6.10 p. m.	.116	.308	.808	+0.38
8	9½ a. m.	.152	.281	.871	+0.36
8	3¼ p. m.	.090	.320	.770	+0.34
8	6¼ p. m.	.079	.330	.749	+0.33
9	9 a. m.	.100	.304	.796	+0.29
9	12 m.	.088	.314	.774	+0.31
9	3 p. m.	.075	.335	.740	+0.37
9	5¾ p. m.	.060	.331	.729	+0.30
11	9½ a. m.	.080	.328	.752	+0.34
11	12 m.	.072	.331	.741	+0.31
11	2½ p. m.	.040	.361	.679	+0.29
11	6 p. m.	.031	.367	.664	+0.26
12	9 a. m.	.060	.334	.726	+0.30
12	12½ p. m.	.066	.340	.726	+0.36

APPENDIX K—Continued.

BAROMETER No. 790—(CISTERN.)

Date.	Time.	Cor. height.	Date.	Time.	Cor. height.
Burnet House, Cincinnati.			*Rogers' Hotel, Fort Smith.*		
June 13	10½ a. m.	29.817	July 4	1½ p. m.	29.708
13	12½ p. m.	.796	4	4¾ p. m.	.691
13	5½ p. m.	.718	5	8.35 a. m.	.769
14	12 m.	.731	5	12.19 p. m.	.760
			5	10¼ p. m.	.733
			6	8¼ a. m.	.787
			6	2 p. m.	.734
Arkansas Hotel, Napoleon.			6	9 p. m.	.792
			7	9½ a. m.	.812
			7	12¼ p. m.	.786
June 24	11 a. m.	30.250	7	3¼ p. m.	.755
			7	6.10 p. m.	.770
			8	9½ a. m.	.835
			8	3¼ p. m.	.736
Anthony House, Little Rock.			8	6¼ p. m.	.716
			9	9 a. m.	.769
			9	12 m.	.743
June 27	8¾ a. m.	29.928	9	3 p. m.	.703
27	12½ p. m.	.910	9	5¾ p. m.	.699
27	6 p. m.	.847	11	9⅓ a. m.	.718
27	9¾ p. m.	.830	11	12 m.	.710
28	10¼ a. m.	.913	11	2½ p. m.	.650
29	7¾ a. m.	.855	11	6 p. m.	.638
29	11½ a. m.	.882	12	9 a. m.	.696
			12	12½ p. m.	.690

NOTE.—Some observations are rejected for obvious errors of reading. Such are detected by comparison of the several instruments at particular observations.

Comparisons by J. Green, maker.—Cistern barometer, No. 790, reads exactly with standard, (Smithsonian); capillary action being corrected by final adjustment of scale, (diameter of tube, 0.23 inch,) no correction is wanted but in reducing temperature to 32° Fahrenheit.

Place of observation.	Date.	Instrument observed.	Ther. att.	Upper ver.	Lower ver.	Height of bar. col.	Diff. of reading.
	1853.			*In.*	*In.*	*In.*	*In.*
No. 422 Broadway, N. Y., 2d floor of James Green's shop.	May	Green's standard.				30.275	
Do do	do	Syphon, No. 780.		31.325	1.020	30.305	+ 0.030
Do do	do	Green's standard.				30.275	
Do do	do	Syphon, No. 785.		31.330	1.052	30.278	.003
Do do	do	Green's standard.				30.108	
Do do	do	Syphon, No. 781.		31.145	1.010	30.135	.027
Do do	do	Green's standard.				30.108	
Do do	do	Syphon, No. 783.		31.282	1.162	30.120	.012
Do do	do	Green's standard.				30.104	
Do do	do	Syphon, No. 784.		31.574	1.449	30.125	+ .021
	1854.						
Steamship Oregon, in the harbor of Acapulco, Mexico.	April 8, 10 p.m.	Spenser and Brown, London.	87.5			30.130	
Do do	do	Syphon, No. 784.	84	31.456	1.368	30.088	— .042
No. 422 Broadway, New York	April 26, 1 p.m.	Green's standard.	69.5			29.757	
Do do	do	Syphon, No. 784.	71	31.284	1.500	29.784	+ 0.027

As the mean result of comparison of all the instruments at the commencement of the survey, the following measures were adopted:

Cistern barometer, No.	790	+.019
Syphon barometer, No.	781	—.031
Do do	783	—.024
Do do	784	—.024
Do do	785	—.012

Comparison was made with the barometer of Dr. Ray, at Cincinnati, giving the following result:

Dr. Ray's cistern,	0.000	
Cistern No.	790	+ .026
Syphon No.	781	— .024
Do	783	— .017
Do	784	— .017

This comparison confirms the corrections determined by mutual comparison of the instruments of the survey.

Next to this verification of instruments, it became necessary to determine the constants proper to be applied in prosecution of the detail of the work. For this purpose there are no precedents in barometric determinations of heights in lines of such extent of continuous and connected survey, and for distances so great from the initial point. Such lines differ widely from isolated and scattered determinations; and observations so made, require the correction of all the variations of barometric reading belonging to constant or regular changes of pressure, at least, and as much of correction for irregular or non-periodic alternations as may be applied. Of the known constant corrections, also, the elements are still imperfect. There is strong reason to suspect the accuracy of that for temperature of the air, particularly when applied to a line in which great changes of surface temperature occur. It is certain, indeed, that these corrections will not apply in case of considerable changes of surface temperature at places having nearly the same elevation; and in the present case, the errors arising in this way were avoided by the use, as much as possible, of mean results from many observations in fixing the elevation of every camp or important point in the line from Fort Smith to Albuquerque.

The horary variations of pressure are another constant too important to be neglected. For these a scale was first applied, deduced from the determinations at Washington and Philadelphia, modified in the extremes of its range to conform to the less considerable changes shown by recent observations to exist in the daily curve of atmospheric pressure at the coast of the Gulf of Mexico. This low scale of horary correction was applied to all the observations from Napoleon, Arkansas, to Camp No. 32, near the Washita river—thus bringing each observation to the mean pressure for the day. The signs, as given in the table, represent the relation of the several hours to the true daily mean of pressure, and are corrections with the opposite sign.*

This degree of correction is not thought sufficient for the comparatively arid climates of the open plains, and is therefore carried only to Camp No. 32.

Horary corrections used from Napoleon to Camp No. 32.

4 a. m.	+.008	3 p. m.	+.006
5 a. m.	+.006	4 p. m.	+.015
6 a. m.	—.002	5 p. m.	+.020
7 a. m.	—.006	6 p. m.	+.018
8 a. m.	—.014	7 p. m.	+.012
9 a. m.	—.018	8 p. m.	+.008
10 a. m.	—.020	9 p. m.	+.005
11 a. m.	—.018	10 p. m.	—.005
12 m.	—.010	11 p. m.	—.005
1 p. m.	—.006	12 p. m.	—.000
2 p. m.	+.003		

The signs have since been changed to represent the corrections as they should be applied to the observations.

For the transition climate from Camp No. 32 forward to near the boundary of New Mexico, a modified scale with a larger range was employed.

Horary corrections applied from Camp No. 32 to Camp No. 50, near the Laguna Colorado.

6 a. m.	—.007	2 p. m.	+.015
7 a. m.	—.020	3 p. m.	+.030
8 a. m.	—.030	4 p. m.	+.045
9 a. m.	—.040	5 p. m.	+.050
10 a. m.	—.050	6 p. m.	+.030
11 a. m.	—.055	7 p. m.	+.020
12 m.	—.025	8 p. m.	+.005
1 p. m.	—.005	9 p. m.	+.000

For New Mexico, and the arid climates of the remainder of the route, a still larger horary variation was found to exist. The quantities were determined from hourly observations, made by the survey at Albuquerque, from the 3d to the 10th of October, for sixteen hours of the day, and continued for six hours daily to November 8. Observations at Zuñi every fifteen minutes on November 22, were also used to establish this curve.

The curves drawn from these observations will be seen to exhibit similar features in all cases, and the corrected curve from which the scale was taken to be so symmetrical as to leave no doubt of the accuracy of this unusually large measure of variation of pressure through the successive hours of the day.

Scale of horary corrections applicable to the arid climates of New Mexico and California.

6 a. m.	—.010	2 p. m.	+.030
7 a. m.	—.030	3 p. m.	+.040
8 a. m.	—.045	4 p. m.	+.050
9 a. m.	—.050	5 p. m.	+.045
10 a. m.	—.057	6 p. m.	+.035
11 a. m.	—.070	7 p. m.	+.025
12 m.	—.032	8 p. m.	+.010
1 p. m.	+.009	9 p. m.	+.005

This important correction for barometric readings used in the determination of heights has scarcely been referred to in previous surveys; and the large values it certainly has along this line should be verified more fully than they yet have been. The correction for horary variation is probably large and important over all the interior, in which the barometer is the chief reliance for determining elevations.

On the immediate coast of the Pacific, this measure of horary variation returns to quantities differing much less from those which belong to the Atlantic States, and it is not clear whether the large daily range of pressure in the interior belongs to aridity in connection with altitude, or to altitude alone. It is believed, however, that the districts having extreme daily changes of temperature, whether caused by altitude or dryness of climate, are affected by similar measures of daily variations of pressure, though the hours at which the extremes occur are later as the district is more elevated.

APPENDIX K—Continued.

ALBUQUERQUE, N. M.—BAROMETER No. 783.

Date.	6 A. M.	7 A. M.	8 A. M.	9 A. M.	10 A. M.	11 A. M.	12 M.	1 P. M.
1853.								
October 4	25.289	25.325	25.323	25.303	25.283	25.282	25.260	25.252
5	.228	.278	.283	.285	.284	.270	.233	.206
6	.236	.254	.250	.246	.216	.202	.180	.167
7	.184	.206	.211	.213	.213	.204	.155	.129
8	.158	.165	.197	.203	.192	.163	.135	.103
9	.124	.116	.122	.121	.102	.080	.053	.041
Means	25.206	25.224	25.231	25.229	25.215	25.200	25.169	25.149

BAROMETER No. 783—Continued.

Date.	2 P. M.	3 P. M.	4 P. M.	5 P. M.	6 P. M.	7 P. M.	8 P. M.	9 P. M.
1853.								
October 4	25.213	25.213	25.196	25.187	25.191	25.197	25.208	25.203
5	.197	.194	.200	.187	.191	.192	.211	.208
6	.138	.124	.105	.098	.121	.141	.136	.140
7	.109	.103	.097	.113	.100	.106	.115	.123
8	.082	.088	.068	.078	.081	.089	.196	.085
9	.029	24.958	24.970	.000	.005	.017	.000	.015
Means	25.128	25.113	25.106	25.110	25.115	25.124	25.128	25.129

NOTE.—In the preliminary work one observation at 9 p. m., October 3, and four observations at 6, 7, 8, and 9 a. m., October 10, were used with the above. As this was a period of considerable abnormal change, the effect of taking such partial observations into the mean was to give an erroneous curve for the diurnal oscillation. The following table gives a scale of corrections applicable to observations made at Albuquerque, N. M. It is to be regretted that the mistake was not discovered in season to allow the original observations to be properly corrected; but the resulting errors are generally small.

Hour.	Mean barometer reading.		Extremes.	Correction. From the daily mean.	Correction. From the mean of the extremes.	Hour.	Mean barometer reading.		Extremes.	Correction. From the daily mean.	Correction. From the mean of the extremes.
6 a. m	25.206			—.46	—38	4 p. m	25.106		.106 minimum	+.54	+62
7 a. m	.224	.224		—.64	—56	5 p. m	.110			+.50	+58
8 a. m	.231		.231 maximum	—.71	—63	6 p. m	.115			+.45	+53
9 a. m	.229			—.69	—61	7 p. m	.124			+.36	+44
10 a. m	.215			—.55	—47	8 p. m	.128			+.32	+40
11 a. m	.200			—.40	—32	9 p. m	.129	.129		+.31	+39
12 m	.169			—.9	—1						
1 p. m	.149			+.11	+19						
2 p. m	.128	.128		+.32	+40						
3 p. m	.113			+.47	+55	Means	25.161	.160	.168		

APPENDIX K—Continued.

ALBUQUERQUE, N. M.—BAROMETER No. 785.

Date.		6 A. M.	9 A. M.	12 M.	3 P. M.	6 P. M.	9 P. M.
1853.							
October	8	----------	25.224	25.164	25.101	25.090	25.100
	9	25.135	.130	----------	24.986	.023	.021
	10	.163	.118	.072	25.021	.029	.049
	11	.113	.203	.169	.135	.122	.132
	12	.160	.178	.129	.063	.051	.082
	13	.092	.099	.078	24.984	.022	.056
	14	.131	.102	.196	----------	.167	.260
	15	.236	.286	.122	25.184	.171	.200
	16	.226	.235	.242	.220	.215	.235
	17	.263	.331	.294	.241	.224	.253
	18	----------	.279	.195	.190	----------	.222
	19	----------	.203	.204	.155	----------	.147
	20	----------	.194	.158	.070	----------	.051
	21	.093	.141	.088	24.981	----------	.004
	22	24.957	24.968	24.890	.886	----------	.058
	23	----------	25.172	25.119	25.120	----------	.185
	24	25.236	.239	.171	.030	24.988	24.948
	25	24.946	24.808	----------	----------	----------	----------
	26	25.009	25.061	.050	.017	25.006	25.036
	27	.125	.121	.200	.074	.106	----------
	28	.222	.227	.342	.342	.344	----------
	29	.167	.454	.484	.422	.412	----------
	30	----------	.419	.350	.381	----------	.436
	31	----------	.051	.074	.010	24.965	24.966
November	1	24.992	24.979	24.954	24.880	.886	.950
	2	25.113	25.184	25.175	25.163	25.177	25.196
	3	.343	.312	.250	.209	.202	.213
	4	----------	.297	.258	.214	----------	.211
	5	----------	.343	.252	.169	----------	----------
	6	----------	----------	.127	.065	----------	.052
	7	.063	.039	.030	----------	----------	----------
	8	.271	.315	----------	----------	----------	.508
Means		25.139	25.184	25.167	25.118	25.116	25.137
Cor. for bar. 785		—.022	.117	.162	.145	.096	.094	.115

CAMP 71, NEAR PUEBLO DE ZUÑI.—BAROMETER No. 790.

Observations November 22 and 23, corrected for temperature.

h. m.	*Inches.*	*h. m.*	*Inches.*	*h. m.*	*Inches.*	*h. m.*	*Inches.*
2 15 p. m.	23.891	8 30 p. m.	23.927	2 45 a. m.	23.912	9 00 a. m.	23.952
2 30 p. m.	.877	8 45 p. m.	.927	3 00 a. m.	.908	9 15 a. m.	.953
2 45 p. m.	.877	9 00 p. m.	.930	3 15 a. m.	.906	9 30 a. m.	.959
3 00 p. m.	.881	9 15 p. m.	.930	3 30 a. m.	.904	9 45 a. m.	.957
3 15 p. m.	.878	9 30 p. m.	.922	3 45 a. m.	.904	10 00 a. m.	.956
3 30 p. m.	.877	9 45 p. m.	.928	4 00 a. m.	.906	10 15 a. m.	.951
3 45 p. m.	.881	10 00 p. m.	.930	4 15 a. m.	.908	10 30 a. m.	.950
4 00 p. m.	.881	10 15 p. m.	.920	4 30 a. m.	.902	10 45 a. m.	.969
4 15 p. m.	.878	10 30 p. m.	.916	4 45 a. m.	.896	11 00 a. m.	.949
4 30 p. m.	.879	10 45 p. m.	.914	5 00 a. m.	.888	11 15 a. m.	.932
4 45 p. m.	.873	11 00 p. m.	.916	5 15 a. m.	.887	11 30 a. m.	.911
5 00 p. m.	.876	11 15 p. m.	.912	5 30 a. m.	.896	11 45 a. m.	.891
5 15 p. m.	.873	11 30 p. m.	.914	5 45 a. m.	.898	12 00 m.	.895
5 30 p. m.	.879	11 45 p. m.	.916	6 00 a. m.	.904	12 15 p. m.	.900
5 45 p. m.	.874	12 00 p. m.	.912	6 15 a. m.	.915	12 30 p. m.	.904
6 00 p. m.	.894	12 15 a. m.	.914	6 30 a. m.	.931	12 45 p. m.	.904
6 15 p. m.		12 30 a. m.	.918	6 45 a. m.	.929	1 00 p. m.	.904
6 30 p. m.	.905	12 45 a. m.	.918	7 00 a. m.	.941	1 15 p. m.	.904
6 45 p. m.	.905	1 00 a. m.	.919	7 15 a. m.	.939	1 30 p. m.	.904
7 00 p. m.	.911	1 15 a. m.	.916	7 30 a. m.		1 45 p. m.	.865
7 15 p. m.	.925	1 30 a. m.	.908	7 45 a. m.	.939	2 00 p. m.	.874
7 30 p. m.	.931	1 45 a. m.	.906	8 00 a. m.	.937	2 15 p. m.	.793
7 45 p. m.	.923	2 00 a. m.	.903	8 15 a. m.	.938		
8 00 p. m.	.915	2 15 a. m.	.906	8 30 a. m.	.946		
8 15 p. m.	.921	2 30 a. m.	.909	8 45 a. m.	.954		

Another element found very important at the outset of the reductions was the non-periodic variation of pressure. Fortunately, several good barometers were observed sufficiently near this part of the line to give an approximate correction for many days. The importance of attention to this source of error is very great in lines determined by successive differences, and every mode of correction and avoidance of it was employed throughout.

The mode previously employed, or whether indeed any mode was employed, to obviate errors arising in this manner, is not given by Nicollet and others who have made determinations in the interior; but the results on this line show careful attention to it to be indispensable.

At Napoleon, for the 24th of June, a non-periodic correction of —.117 was applied to the mean of the barometric readings, obtained from comparison with full records at Lebanon, Glenwood, and Memphis, Tennessee, and at New Orleans.

A less correction was applied at Little Rock; at Fort Smith the correction —.027 was applied to the mean of all the readings, and beyond this the corrections given below:

July 28th	+.030
July 29th	+.050
July 30th	+.080
July 31st	+.070
August 1st	+.030
August 3d	—.080
August 4th	—.080
August 5th	—.040
August 7th	—.020
August 8th	—.060
August 9th	—.050

Further correction in this manner was impossible; but the more important points were determined from observations carried through two or more days, and such points were made bases for reference of minor camps and intermediate stations.

The line was carried forward by reference of Camp No. 2 to the sea-level, assuming 30.050 inches as the mean pressure at the gulf with the barometer corrected to 32°, and the air temperature at 64°; and by subsequent reference of the principal camps to each other, correcting the differences to the station having the greatest number of observations, and correcting intermediate lines, determined by minor camps and single stations, proportionally, for the error of their terminus.

At Albuquerque, a reference of the mean of its numerous observations was again made to sea-level, and the elevations eastward to Laguna Colorada were determined by differences from this point. The error resulting from non-periodic variation is mainly avoided in this manner, and the lines from these different bases agree very nearly at their terminus.

Beyond Albuquerque, the elevations are determined by mutual and cross reference of principal camps to each other, to Leroux's spring, Camp No. 91. At the mouth of Bill Williams' fork a new base was determined, with which the elevations eastward were compared as far as Camp No. 91, correcting the principal camps by direct reference to the sea. The same elements were taken for sea-level as before, viz: 30.050 inches as barometric height at 32°, and the air temperature at 64°. This check by direct reference to the sea, gives but slight corrections on the determinations by consecutive comparisons from the Colorado, and the lines agree very nearly at their terminus at Camp No. 91. The differences for single stations and minor camps are, however, sometimes considerable. These are corrected by taking departures from each principal camp, and correcting the elevations proportionally from their point of meeting midway.

West of the Colorado, the line is carried forward by differences from the mean of the three first camps at the point of departure, otherwise as before, and its terminus at the Pacific is without important error.

Through the entire line it has been sought to harmonize the results, as a survey of consecutive differences, with those obtained by new points of reference to the sea-level, and by reference of distant camps to the initial point, and to one another. To reconcile these absolutely on a line of such extent, and nearly across the continent, could not be anticipated, as there are sources of great error in non-periodic variations of pressure, and in the variable value of observations at the several camps and stations. Every check possible to be applied to the results has been applied, and the principal points are believed to be very near to accuracy.

All the constants of correction have been fully applied. A variable error from variation of pressure among the months would give a slight reduction of the elevations at Albuquerque and eastward to the sources of the Canadian. West of Albuquerque it would slightly add to the elevations.

CLIMATOLOGY.

The accompanying chart is prepared to give a comparison of the distribution of rain over the portion of the continent traversed by this line of survey. It is copied from a general chart of mean annual fall of rain for all parts of the continent as determined from the entire amount of American observation of this character. Most of the amounts are from positive measurements. Those for the interior, in positions not occupied by military posts at which observations have been made, are estimated from the climatological descriptions of chiefs of surveys and reconnoissances, and from general climatological laws.

Thus, a more abundant fall of rain in the tract bordering the Canadian than either north or south of it, is inferred from the less elevation of the mountains westward and southwestward. Rains are not wholly arrested by these mountains as by the greater elevations northward, and at the south the border of the region of summer rains is not far off. The Estacado of Texas, the Rio Grande valley, and the Plains of the Gila, are in *desert latitudes*, or between the tropical and temperate climates. Few measurements have been taken of amount of rain on the Canadian, but the comparative abundance of rain in this belt is fully shown in the naratives of the survey.

West of the Rio Grande, the Zuñi plateaux and the adjacent mountains and districts are known to be comparatively well watered. The still more elevated mountains at the sources of the Rio Grande arrest an immense precipitation, and the extension westward of this profusion of rains, at certain seasons at least, is farthest at the 35th parallel, and on the San Francisco mountains and the adjacent plateaux. The Sierra Madre and coast ranges of mountains have also an abundant precipitation, though mainly confined to certain seasons, and not equally distributed through the year.

Generally the districts near the 35th parallel on the western part of this continent are at the southern border of the regions of equally distributed rains. Those bordering the 30th parallel are the most extremely arid—the normal desert climates, though locally relieved in many cases. Southward, or at the 25th parallel, the summer rainy season and the alternations of tropical climates are fully instituted.

The temperature distribution of this portion of the continent is unimportant, except that its elevation moderates its extreme heats and gives it a general resemblance to that of the 40th parallel in the eastern United States. The valley of the Colorado of California is an exception, however, having very high temperatures, but a very dry, elastic atmosphere. The cool invigorating climates of the immediate coast of the Pacific are also a striking and valuable feature of this general climatology.

APPENDIX L.

TABLE OF RESULTS FOR ABNORMAL VARIATIONS OF ATMOSPHERIC PRESSURE, AS DETERMINED FROM BAROMETRIC RECORDS KEPT AT VARIOUS WESTERN MILITARY POSTS.

Observations at Fort Gibson, by Surgeon B. Randall, U. S. A.

VARIATION.		VARIATION.		VARIATION.		VARIATION.	
Date.	Amount.	Date.	Amount.	Date.	Amount.	Date.	Amount.
1853.		1853.		1853.		1853.	
Mean for June, 29.444		July 18	—.035	Aug. 11	+.053	Sept. 4	—.133
		19	—.015	12	+.069	5	—.132
June 23	+.102	20	+.017	13	+.035	6	—.067
24	+.213	21	+.014	14	+.023	7	+.026
25	+.147	22	—.026	15	+.000	8	+.048
26	+.006	23	—.078	16	—.005	9	+.064
27	—.036	24	—.113	17	—.041	10	+.083
28	—.058	25	—.006	18	—.060	11	+.080
29	—.065	26	+.088	19	—.091	12	+.038
30	—.011	27	+.078	20	—.135	13	—.127
		28	+.059	21	—.147	14	—.183
Mean for July, 29.447		29	+.065	22	—.104	15	—.188
		30	+.080	23	—.062	16	—.216
July 4	+.009	31	+.045	24	+.040	17	—.216
5	+.047			25	+.065	18	—.183
6	+.073	Mean for Aug., 29.395		26	+.030	19	+.044
7	+.095			27	+.179	20	+.171
8	+.097	Aug. 1	+.054	28	+.174	21	+.249
9	+.074	2	—.045	29	+.123	22	+.185
10	+.027	3	—.091	30	+.066	23	+.101
11	+.015	4	—.093	31	—.027	24	+.106
12	+.006	5	—.052			25	+.118
13	+.004	6	—.018	Mean for Sept., 29.438		26	+.144
14	+.014	7	+.023			27	+.148
15	—.010	8	+.024	Sept. 1	—.066	28	+.071
16	—.015	9	+.010	2	—.047	29	+.011
17	—.057	10	+.024	3	—.040	30	+.027

NOTE.—Where two months join with different means as bases, the numbers are modified in application so as to render them comparable.

APPENDIX L—Continued.

Comparison of abnormal variations at Fort Gibson and at Albuquerque for October, 1853.

Fort Gibson.		Albuquerque.		Fort Gibson.		Albuquerque.	
Date.	Amount.	Date.	Amount.	Date.	Amount.	Date.	Amount.
Mean for Oct., 29.502		Mean from Oct. 4 to Nov. 8, 25.121.					
October 1	+.053			October 17	+.119	October 17	+.125
2	+.094			18	+.110	18	+.079
3	+.100	October 3, (9 p. m.)	+.110	19	+.096	19	+.030
4	+.039	4	+.082	20	—.091	20	—.025
5	+.023	5	+.087	21	—.257	21	—.082
6	+.024	6	+.019	22	—.100	22	—.191
7	+.009	7	+.002	23	+.117	23	—.006
8	—.046	8	—.007	24	+.116	24	—.041
9	—.166	9	—.084	25	—.234	25	—.266
10	—.131	10	—.068	26	—.196	26	—.113
11	+.006	11	+.026	27	—.079	27	—.039
12	+.003	12	+.033	28	+.031	28	+.152
13	—.041	13	—.088	29	+.257	29	+.245
14	—.053	14	+.028	30	+.139	30	+.253
15	+.022	15	+.057	31	—.097	31	—.130
16	+.080	16	+.086				

Comparison of abnormal variations at Fort Gibson and at Albuquerque for November, 1853.

Fort Gibson.		Albuquerque.		Fort Gibson.	
Date.	Amount.	Date.	Amount.	Date.	Amount.
Mean for Nov., 29.550		Mean from Oct. 4 to Nov. 8, 25.126.			
November 1	—.302	November 1	—.181	November 16	—.190
2	—.046	2	+.047	17	—.146
3	+.222	3	+.134	18	—.037
4	+.185	4	+.124	19	—.029
5	+.163	5	+.134	20	+.050
6	+.173	6	+.000	21	+.073
7	+.052	7	—.077	22	+.052
8	—.034	8	+.244	23	—.054
9	+.254			24	+.179
10	—.045			25	+.159
11	—.279			26	+.160
12	—.075			27	+.031
13	+.053			28	—.155
14	—.278			29	+.027
15	—.286			30	+.025

Observations at Fort Yuma by Asst. Surgeon J. J. Milhau, U. S. A.

Date.	Daily mean.	Amount of variation.	Date.	Daily mean.	Amount of variation.
1853.			1853.		
December 11	29.663 (3 obs.)		December 19	29.830	
12	.650 (4)		20	.822	
13	.660		21	.787	
14	.762		22	.775	
15	.832		23	.935	
16	.945		24	.895	
17	.983		25	.945	
18	.815		26	30.018	

APPENDIX L—Continued.

Date.	Daily mean.	Amount of variation.	Date.	Daily mean.	Amount of variation.
1853.			1853.		
December 27	30.060		January 16	29.867	— 0.059
28	29.940		17	.942	+ .016
29	.922		18	.807	— .119
30	30.132		19	.637	— .289
31	30.102	+ 0.176	20	30.070	+ .144
1854.			21	.160	+ .234
January 1	30.020	+ .094	22	.097	+ .171
2	.012	+ .086	23	29.982	+ .056
3	29.995	+ .069	24	.902	— .024
4	.828	— .098	25	.807	— .119
5	.690	— .236	26	.970	+ .044
6	30.012	+ .086	27	30.080	+ .154
7	.175	+ .249	28	.022	+ .096
8	.082	+ .156	29	.012	+ .086
9	29.942	+ .016	30	.005	+ .079
10	.928	+ .002	31	29.870	— .056
11	.952	+ .026	February 1	.710	— .216
12	.745	— .181	2	.857	— .069
13	.737	— .189	3	.875	— .051
14	.617	— .309	4	.830	— .096
15	29.750	— 0.176	5	29.880	— 0.046

Mean for January, 29.926.

Observations at Great Salt Lake, from Captain Beckwith's survey.

Date.	Daily mean.	Amount of variation.	Date.	Daily mean.	Amount of variation.
1853.			1854.		
Nov'r 29	25.754	+ 0.086	January 1		
30	.833	+ .165	2	25.820	
Dec'r 1	.840	+ .172	3	.538	
2	.800	+ .132	4	.395	
3	.781	+ .113	5	.594	
4 9 a.m	.736	+ .068	6	.849	
5	.738	+ .070	7	26.000	
6	.903	+ .235	8		
7	.912	+ .244	9 9 a.m	25.701	+ 0.086
8	.835	+ .167	10	.768	+ .153
9	.552	— .116	11	.578	— .037
10	.416	— .252	12	.290	— .325
11	.429	— .239	13	.146	— .469
12	.636	— .032	14	.001	— .614
13	.396	— .272	15	.149	— .466
14	.331	— .337	16	.304	— .311
15 9 a.m	.378	— .290	17	.276	— .339
16	.667	— .001	18	.385	— .230
17 9 a.m	.673	+ .005	19	.118	— .497
18 9 a.m	.689	+ .017	20	.819	+ .204
19	.692	+ .024	21	.737	+ .122
20	.494	— .174	22	.954	+ .339
21	.483	— .185	23	.866	+ .251
22 9 a.m. & 12m.	.613	— .055	24	.639	+ .024
23	.647	— .021	25	.450	— .165
24	.530	— .138	26	.818	+ .203
25 ded'd fm. Ft. Yuma	.452	— .216	27	.948	+ .333
26	.623	— .045	28	.917	+ .302
27	.670	+ .002	29 9 a.m	.897	+ .282
28	.525	— .143	30		
29	.550	— .118	31 9 a.m	25.866	+ 0.251
30 9 a.m	.770	+ .102			
31 9 a.m. & 12m.	25.913	+ 0.245	Mean for Jan., 25.615		

Mean for Dec. 25.668

APPENDIX L—Continued.

Date.	Daily mean.	Variations at Great Salt Lake.	Variations at San Diego.	Mean of variations.	Date.	Daily mean.	Variations at Great Salt Lake.	Variations at San Diego.	Mean of variations.
1854.					1854.				
February 1	25.455	----------	----------	----------	February 16	25.546	— 0.072	— 0.126	— 0.099
2	.776	----------	----------	----------	17	.553	— .065	— .160	— .107
3	.680	----------	----------	----------	18	.562	— .056	+ .017	— .020
4	.657	----------	----------	----------	19	.604	— .014	+ .123	+ .055
5	.662	+ 0.044	+ 0.025	+ 0.035	20	.579	— .039	+ .106	+ .033
6	.622	+ .004	+ .079	+ .041	21	.677	+ .059	+ .093	+ .071
7	.632	+ .014	+ .038	+ .026	22	.779	+ .161	+ .080	+ .120
8	.722	+ .104	— .011	+ .046	23	.618	+ .00	+ .114	+ .057
9	.598	— .020	— .062	— .041	24	.683	+ .065	+ .079	+ .072
10	.398	— .220	— .086	— .153	25	.659	+ .041	+ .061	+ .051
11	.189	— .429	— .117	— .273	26	.509	— .109	+ .055	— .027
12	.304	— .314	+ .024	— .145	27	.581	— .037	+ .079	+ .021
13	.372	— .246	+ .036	— .105	28	.289	— .329	+ .094	— .118
14	.633	+ .015	+ .042	+ .028	March 1	25.472	— 0.146	+ 0.107	— 0.019
15	25.649	+ 0.031	+ 0.042	+ 0.036					

Mean for February, 25.571.

Mean for December, January, and February, 25.618.

Observations at Mission of San Diego, California, by W. S. King, M. D., and C. C. Kerney, M. D., Assistant Surgeons U. S. A.

Date.	Daily mean.	Amount of variation.	Date.	Daily mean.	Amount of variation.	Date.	Daily mean.	Amount of variation.	Date.	Daily mean.	Amount of variation.
Feb. 1	29.228	— .144	Feb. 15	29.414	+ .042	Mar. 1	29.479	+ .107	Mar. 17	29.288	— .084
2	29.304	— .068	16	29.246	— .126	2	29.476	+ .104	18	29.269	— .103
3	29.356	— .016	17	29.212	— .160	3	29.392	+ .020	19	29.351	— .021
4	29.366	— .006	18	29.389	+ .017	4	29.369	— .003	20	29.343	— .029
5	29.397	+ .025	19	29.495	+ .123	5	29.314	— .058	21	29.310	— .062
6	29.451	+ .079	20	29.478	+ .106	6	29.301	— .071	22	29.342	— .030
7	29.410	+ .038	21	29.465	+ .093	7	29.183	— .189	23	29.346	— .026
8	29.361	— .011	22	29.452	+ .080	8	29.227	— .145	24	29.342	— .030
9	29.311	— .061	23	29.486	+ .114	9	29.324	— .048	25	29.404	+ .032
10	29.286	+ .084	24	29.451	+ .079	10	29.390	+ .018	26	29.350	— .022
11	29.255	— .117	25	29.433	+ .061	11	29.312	— .060	27	29.456	+ .084
12	29.396	+ .024	26	29.427	+ .055	12	29.297	— .075	28	29.445	+ .073
13	29.408	+ .036	27	29.451	+ .079	13	29.317	— .055	29	29.466	+ .094
14	29.414	+ .042	28	29.466	+ .094	14	29.304	— .068	30	29.454	+ .082
						15	29.340	— .032	31	29.420	+ .048
						16	29.353	— .019			

Mean for February and March, 29.372.

APPENDIX M.

TABLE OF BAROMETRIC ALTITUDES.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1	Napoleon	5	5	142.1	49	Camp 4, Cache creek	10	1	552.5
2	Little Rock	50	5	351.4	50	Foot-hill, edge of prairie	1	1	528.9
3	Fort Smith	114	5	468.7	51	Top	1	1	668.9
4	Camp Wilson	28	1	466.4	52	Prairie, S. camp, 3	1	1	575.8
5	Ast. Station	------	------	458.4*	53	Top of hill	1	1	642.8
6	Flagstaff, Fort Smith	------	------	465.8*	54	Hill-top	1	1	571.7
7	East bank, Poteau river	------	------	450.2*	55	Bottom	1	1	499.7
8	Foot of bank	------	------	423.7*	56	Station 6012	1	1	579.4
9	Water's edge, east	------	------	417.6*	57	John's House	1	1	595.4
10	Water's edge, west bank	------	------	417.6*	49	Camp 4, Cache creek	10	1	552.5
11	West bank	------	------	428.3*	58	Station 6	1	1	574.1
12	Station 10	------	------	431.5*	59	4 miles from camp	1	1	683.4
13	15	------	------	430.4*	60	Camp 5, Br. Sans Bois cr'k	4	1	653.5
14	20	------	------	430.9*	61	Station 4	1	1	582.5
15	25	------	------	435.1*	62	5	1	1	624.5
16	30	------	------	439.7*	63	6	1	1	630.7
17	71	1	1	448.0	64	7	1	1	632.9
18	100	1	1	439.2	65	8	1	1a†	625.7
19	139	1	1	423.3	66	10	1	1a	619.6
20	182	1	1	430.1	67	11	1	1a	641.4
21	199	1	1	436.9	68	13	1	1a	619.2
22	207	1	1	439.5	69	15	1	1a	630.4
23	225	1	1	448.3	70	16	1	1a	639.0
24	269	1	1	441.5	71	17	1	1a	637.9
25	287	1	1	444.9	72	18	1	1a	609.5
26	340	1	1	455.5	73	19	1	1a	596.0
27	392	1	1	462.3	74	Camp 6, Coon creek	4	1m	583.7
28	Camp 1, Ring's plantation	33	2	493.1	75	Station 1	1	1m	579.8
29	Station 595	1	1	502.2	76	6	1	1a	580.4
30	561 + 50 feet	1	1	550.1	77	7	1	1a	585.5
31	666 + 77 feet	1	1	578.6	78	10	1	1a	581.6
32	681 + 72 feet	1	1	592.2	79	20	1	1a	555.2
33	695	1	1	606.6	80	21	1	1a	546.8
34	707 + 90 feet	1	1	602.6	81	22	1	1m	549.2
35	720 + 93 feet	1	1	587.1	82	23	1	1a	556.8
36	736	1	1	593.6	83	24	1	1a	524.8
37	Hill-top	1	1	586.0	84	25	1	1a	546.7
38	Ravine	1	1	545.9	85	27	1	1a	534.7
39	Camp 2, Seullyville	65	1	539.5	86	29	1	1a	524.7
40	Station 8	1	1	589.0	87	30	1	1a	518.2
41	20	1	1	619.6	88	32	1	1a	542.3
42	55	1	1	535.0	89	33	1	1a	565.1
43	70	1	1	535.0	90	34	1	1a	554.2
44	Near Poteau river	1	1	544.0	91	35	1	1a	547.8
45	------Do	1	1	521.5	92	36	1	1a	545.7
39	Camp 2, Seullyville	65	1	539.5	93	38	1	1a	552.4
46	Camp 3, Camp creek	3	1	568.0	94	39	1	1a	553.8
47	Sta. 26, road survey	1	1	564.2	95	41	1	1a	563.1
48	12 M. station	1	1	554.0	96	42	1	1a	555.8

* Height determined by survey from Camp Wilson with spirit-level.

† *a* denotes that the instrument used was an Aneroid barometer. At all the camps, and at most of the principal points between, observations by Mercurial Syphon or Cistern barometers only are taken into account.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
97	Station 43	1	1*m*	596.8
98	44	1	1*a*	593.9
99	46	1	1*a*	569.8
100	47	1	1*a*	572.1
101	48	1	1*a*	565.7
102	50	1	1*a*	568.0
103	Camp 7, Sans Bois creek	4	4*m*	551.9
104	Station 5	1	1*a*	580.4
105	11	1	1	577.1
106	12	1	1	573.8
107	13	1	1	581.3
108	16	1	1	589.7
109	18	1	1	599.9
110	19	1	1	601.1
111	20	1	1	611.3
112	21	1	1	603.5
113	22	1	1	600.2
114	23	1	1	596.9
115	24	1	1	637.7
116	25	1	1	643.4
117	26	1	1	653.6
118	27	1	1	654.8
119	28	1	1	656.0
120	29	1	1	665.2
121	30	1	1	665.5
122	31	1	1	665.8
123	32	1	1	666.1
124	33	1	1	661.9
125	34	1	1	675.5
126	35	1	1	684.7
127	36	1	1	687.7
128	37	1	1	688.0
129	38	1	1	683.8
130	39	1	1	688.6
131	40	1	1	686.2
132	41	1	1	680.2
133	42	1	1	680.5
134	43	1	1	694.1
135	44	1	1	689.9
136	45	1	1	681.3
137	46	1	1	686.1
138	47	1	1	686.4
139	48	1	1	686.7
140	49	1	1	697.7
141	50	1	1	694.4
142	52	1	1	692.8
143	53	1	1	684.3
144	54	1	1	682.8
145	55	1	1	676.8
146	56	1	1	672.6
147	57	1	1	673.8
148	58	1	1	668.0
149	59	1	1	653.4
150	60	1	1	656.5
151	61	1	1	655.1
152	62	1	1	653.7
153	63	1	1	644.3
154	64	1	1	643.8
155	66	1	1	634.4
156	67	1	1	643.0
157	69	1	1	639.8
158	71	1	1	658.9
159	72	1	1	655.7
160	73	1	1	661.5
161	75	1	1	671.7
162	76	1	1	665.8
163	Station 77	1	1	666.1
164	78	1	1	665.7
165	79	1	1	651.1
166	80	1	1	664.8
167	81	1	1	669.8
168	Camp 8, Sans Bois creek	3	1	648.4
169	Station 1	1	1	687.1
170	2	1	1	708.8
171	3	1	1	717.2
172	4	1	1	738.9
173	5	1	1	755.2
174	6	1	1	776.9
175	7	1	1	793.4
176	8	1	1	814.2
177	9	1	1	857.3
178	10	1	1	875.4
179	11	1	1	884.7
180	13	1	1	861.1
181	14	1	1	863.3
182	15	1	1	861.9
183	16	1	1	850.7
184	17	1	1	813.7
185	18	1	1	758.0
186	19	1	1	729.0
187	20	1	1	740.9
188	21	1	1	730.5
189	22	1	1	758.3
190	23	1	1	757.0
191	24	1	1	754.7
192	25	1	1	753.3
193	26	1	1	746.5
194	27	1	1	763.0
195	28	1	1	738.5
196	29	1	1	732.6
197	30	1	1	699.2
198	31	1	1	697.8
199	32	1	1	713.5
200	33	1	1	703.1
201	34	1	1	706.2
202	35	1	1	722.7
203	36	1	1	707.0
204	38	1	1	696.7
205	39	1	1	721.3
206	41	1	1	711.0
207	42	1	1	726.7
208	43	1	1	725.3
209	44	1	1	746.9
210	45	1	1	721.5
211	46	1	1	720.1
212	47	1	1	736.6
213	49	1	1	746.7
214	50	1	1	760.4
215	51	1	1	772.3
216	52	1	1	775.4
217	55	1	1	809.6
218	56	1	1	803.7
219	57	1	1	802.3
220	59	1	1	787.6
221	60	1	1	781.7
222	61	1	1	758.1
223	62	1	1	747.8
224	63	1	1	720.6
225	64	1	1	685.5
226	65	1	1	676.0
227	66	1	1	671.0
228	68	1	1	666.0

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
229	Station 69	1	1	674.4
230	70	1	1	673.9
231	71	1	1	668.9
232	72	1	1	674.4
233	Camp 9, Santa Rita cr'k	10	1	680.3
234	Station 1	1	1	680.1
235	2	1	1	679.9
236	3	1	1	679.7
237	4	1	1	697.3
238	5	1	1	697.2
239	6	1	1	705.9
240	10	1	1	705.7
241	11	1	1	696.6
242	13	1	1	696.4
243	14	1	1	696.2
244	17	1	1	704.9
245	18	1	1	704.7
246	19	1	1	695.6
247	20	1	1	695.4
248	21	1	1	699.7
249	22	1	1	695.0
250	24	1	1	694.8
251	26	1	1	694.6
252	27	1	1	689.9
253	28	1	1	687.9
254	29	1	1	677.0
255	31	1	1	632.3
256	32	1	1	632.1
257	33	1	1	680.8
258	34	1	1	677.0
259	35	1	1	677.7
260	36	1	1	673.9
261	37	1	1	679.1
262	39	1	1	666.4
263	40	1	1	644.8
264	41	1	1	644.6
265	45	1	1	654.2
266	46	1	1	644.2
267	47	1	1	643.1
268	49	1	1	642.9
269	52	1	1	650.7
270	53	1	1	649.6
271	56	1	1	644.9
272	57	1	1	650.1
273	58	1	1	665.9
274	59	1	1	647.0
275	60	1	1	668.2
276	61	1	1	681.3
277	62	1	1	680.2
278	63	1	1	674.6
279	68	1	1	686.9
280	72	1	1	673.3
281	74	1	1	676.7
282	77	1	1	671.1
283	78	1	1	679.8
284	79	1	1	684.1
285	81	1	1	706.2
286	82	1	1	706.0
287	83	1	1	706.7
288	84	1	1	711.9
289	85	1	1	713.7
290	87	1	1	686.8
291	89	1	1	668.8
292	90	1	1	665.0
293	91	1	1	663.9
294	92	1	1	643.2
295	Station 95	1	1	661.7
296	97	1	1	666.9
297	101	1	1	679.0
298	107	1	1	687.7
299	110	1	1	669.7
300	113	1	1	665.0
301	114	1	1	664.8
302	116	1	1	664.6
303	117	1	1	642.3
304	118	1	1	642.1
305	119	1	1	642.8
306	123	1	1	624.8
307	125	1	1	642.4
308	127	1	1	641.3
309	129	1	1	631.3
310	130	1	1	630.0
311	Camp 10, La Honda	3	1	632.3
312	Station 1	1	1	632.3
313	4	1	1	637.7
314	5	1	1	638.6
315	6	1	1	638.6
316	7	1	1	644.9
317	8	1	1	645.8
318	10	1	1	646.7
319	12	1	1	638.7
320	14	1	1	644.1
321	15	1	1	622.8
322	16	1	1	623.7
323	17	1	1	615.7
324	18	1	1	635.3
325	19	1	1	642.5
326	20	1	1	650.6
327	21	1	1	664.9
328	23	1	1	661.3
329	24	1	1	662.2
330	25	1	1	668.6
331	26	1	1	675.0
332	27	1	1	734.7
333	28	1	1	736.6
334	29	1	1	737.6
335	30	1	1	747.6
336	31	1	1	730.1
337	32	1	1	694.0
338	Camp 11, Gaines' creek	5	1	678.2
339	Station 2	1	1	697.8
340	4	1	1	659.9
341	5	1	1	658.0
342	7	1	1	679.4
343	8	1	1	699.8
344	9	1	1	706.1
345	10	1	1	703.5
346	12	1	1	698.2
347	13	1	1	692.8
348	14	1	1	691.0
349	15	1	1	685.0
350	16	1	1	679.8
351	17	1	1	638.8
352	18	1	1	660.3
353	19	1	1	678.3
354	20	1	1	655.3
355	21	1	1	636.8
356	22	1	1	644.9
357	24	1	1	635.3
358	25	1	1	643.5
359	26	1	1	661.5
360	27	1	1	669.6

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
361	Station 28	1	1	652.0	427	Station 7	1	1	684.6
362	29	1	1	674.3	428	8	1	1	698.6
363	30	1	1	674.4	429	9	1	1	690.3
364	31	1	1	681.6	430	10	1	1	704.3
365	32	1	1	696.8	431	11	1	1	704.9
366	33	1	1	674.2	432	12	1	1	705.5
367	34	1	1	687.6	433	14	1	1	741.9
368	35	1	1	687.7	434	15	1	1	760.3
369	36	1	1	687.8	435	Foot of hill	1	1	698.3
370	37	1	1	687.9	436	17	1	1	717.7
371	40	1	1	692.5	437	18	1	1	731.7
372	41	1	1	697.1	438	19	1	1	745.7
373	42	1	1	697.2	439	20	1	1	777.7
374	45	1	1	697.3	440	21	1	1	755.9
375	49	1	1	693.0	441	22	1	1	756.5
376	50	1	1	697.6	442	23	1	1	756.9
377	51	1	1	697.7	443	24	1	1	757.3
378	52	1	1	693.3	444	25	1	1	753.4
379	53	1	1	693.4	445	26	1	1	753.1
380	54	1	1	698.6	446	27	1	1	729.5
381	55	1	1	698.7	447	28	1	1	723.8
382	56	1	1	694.3	448	29	1	1	719.0
383	57	1	1	694.5	449	30	1	1	713.2
384	58	1	1	690.2	450	31	1	1	710.1
385	60	1	1	708.1	451	32	1	1	709.0
386	61	1	1	708.2	452	33	1	1	728.1
387	62	1	1	712.8	453	34	1	1	727.0
388	64	1	1	713.0	454	35	1	1	723.6
389	65	1	1	699.8	455	36	1	1	727.6
390	66	1	1	735.6	456	38	1	1	721.0
391	67	1	1	752.6	457	39	1	1	707.0
392	68	1	1	701.1	458	42	1	1	696.3
393	69	1	1	676.3	459	43	1	1	701.0
394	70	1	1	613.3	460	Camp 13, Br. Coal creek	3	1	692.7
395	72	1	1	722.0	461	Station 2	1	1	682.0
396	74	1	1	687.4	462	Bank of creek	1	1	670.0
397	76	1	1	618.1	463	3	1	1	678.0
398	77	1	1	611.0	464	4	1	1	681.0
399	78	1	1	613.0	465	5	1	1	681.0
400	79	1	1	623.8	466	7	1	1	685.0
401	80	1	1	625.8	467	8	1	1	724.0
402	82	1	1	632.3	468	10	1	1	709.0
403	86	1	1	651.9	469	11	1	1	716.0
404	87	1	1	649.3	470	13	1	1	723.0
405	91	1	1	658.4	471	14	1	1	735.0
406	92	1	1	648.8	472	15	1	1	746.0
407	93	1	1	651.0	473	16	1	1	771.0
408	94	1	1	657.6	474	21	1	1	730.0
409	96	1	1	664.2	475	23	1	1	728.0
410	97	1	1	669.1	476	25	1	1	745.0
411	98	1	1	667.6	477	27	1	1	743.0
412	99	1	1	668.8	478	29	1	1	728.0
413	100	1	1	688.0	479	32	1	1	780.0
414	102	1	1	657.2	480	34	1	1	769.5
415	103	1	1	648.5	481	35	1	1	781.3
416	105	1	1	641.0	482	37	1	1	829.3
417	Bank of Coal creek	1	1	636.8	483	38	1	1	823.1
418	106	1	1	642.4	484	39	1	1	770.4
419	108	1	1	648.3	485	41	1	1	755.2
420	109	1	1	653.0	486	Gully betw. 41 and 42	1	1	718.7
421	Camp 12, Coal creek	2	1	654.5	487	42	1	1	744.0
422	0	1	1	681.6	488	43	1	1	747.4
423	1	1	1	677.7	489	44	1	1	768.0
424	2	1	1	678.3	490	45	1	1	749.4
425	4	1	1	692.3	491	47	1	1	734.0
426	6	1	1	692.9	492	48	1	1	787.6

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer stations.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
493	Station 52	1	1	772.6	556	Station 3	1	1	771.9
494	57	1	1	793.0	557	4	1	1	833.7
495	58	1	1	790.5	558	5	1	1	890.1
496	61	1	1	788.7	559	6	1	1	883.5
497	72	1	1	791.0	560	8	1	1	867.9
498	78	1	1	810.8	561	9	1	1	856.8
499	86	1	1	872.0	562	12	1	1	996.0
500	87	1	1	881.5	563	20	1	1	811.2
501	95	1	1	846.5	564	21	1	1	837.9
502	97	1	1	851.5	565	24	1	1	842.1
503	101	1	1	854.7	566	26	1	1	832.8
504	Camp 14, head of Coal cr	4	1	833.2	567	27	1	1	841.5
505	Station 3	1	1	847.1	568	29	1	1	791.7
506	6	1	1	843.9	569	Gully with water	1	1	822.3
507	7	1	1	827.2	570	Station 32	1	1	858.0
508	10	1	1	809.6	571	33	1	1	869.4
509	13	1	1	815.4	572	35	1	1	881.7
510	14	1	1	833.8	573	37	1	1	913.0
511	Gully in adv. of sta. 15	1	1	826.1	574	38	1	1	856.9
512	Station 16	1	1	865.4	575	39	1	1	918.7
513	Top of hill	1	1	881.8	576	40	1	1	904.0
514	Gully—station 20 to 21	1	1	846.2	577	41	1	1	884.8
515	Station 21	1	1	861.0	578	Gully	1	1	851.2
516	Sandy bed betw. stations 22 and 23.	1	1	857.4	579	Station 42	1	1	875.9
					580	43	1	1	846.0
517	Station 23	1	1	879.8	581	Camp 16, Shawnee town	3	1	826.3
518	24	1	1	882.5	582	Station 47	1	1	851.4
519	Top of hill, station 25	1	1	924.3	583	48	1	1	842.3
520	Top of hill, station 27	1	1	959.8	584	48 + 100 yards	1	1	834.1
521	Station 29	1	1	992.6	585	Gully foot of mountain	1	1	842.1
522	33	1	1	1043.4	586	Station 50, top of mount	1	1	881.6
523	35	1	1	970.0	587	53	1	1	867.1
524	40	1	1	1036.1	588	54	1	1	888.6
525	53	1	1	829.5	589	57	1	1	901.1
526	54	1	1	862.3	590	1	1	1	892.9
527	57	1	1	798.8	591	Ravine	1	1	865.7
528	58	1	1	811.8	592	Station 2	1	1	882.7
529	61	1	1	864.4	593	3	1	1	863.7
530	65	1	1	864.8	594	4	1	1	898.7
531	Gully between st. 65 & 66.	1	1	862.5	595	5	1	1	915.7
532	Station 66	1	1	864.7	596	9	1	1	891.3
533	67	1	1	867.8	597	10	1	1	870.5
534	69	1	1	920.4	598	11	1	1	886.6
535	71	1	1	894.9	599	14	1	1	910.8
536	78	1	1	834.0	600	20	1	1	908.0
537	80	1	1	790.3	601	21	1	1	878.2
538	81	1	1	787.0	602	24	1	1	827.5
539	82	1	1	784.6	603	Ravine	1	1	821.8
540	Gully in front of stat'n 82.	1	1	787.8	604	Camp 17, Br. Boggy river	22	1	838.6
541	83	1	1	776.4		17			838.6
542	Gully—sta. 83 + 25 yds.	1	1	773.2	605	Station 27	1	1	841.9
543	Station 84	1	1	778.0	606	31	1	1	853.3
544	87	1	1	919.7	607	32	1	1	841.3
545	89	1	1	897.6	608	33	1	1	820.3
546	90	1	1	876.4	609	36	1	1	817.3
547	101	1	1	886.7	610	Ravine on Boggy river	1	1	802.6
548	104	1	1	876.2	611	Station 37	1	1	799.6
549	Gully—station 107	1	1	829.9	612	43	1	1	898.3
550	Station 109	1	1	864.5	613	Ravine	1	1	886.3
551	110	1	1	855.0	614	Station 46	1	1	910.3
552	111	1	1	819.4	615	49	1	1	862.3
553	112	1	1	815.3	616	50	1	1	836.8
554	*Camp 15, Shawnee vil'ge.	3	1	812.1	617	51	1	1	833.8
555	2	1	1	738.0	618	52	1	1	863.2

*Fall of river, from this point to Fort Smith, at the rate of two feet per mile.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
619	Station 53	1	1	828.7
620	Top of hill	1	1	835.6
621	Station 57	1	1	878.5
622	58	1	1	871.0
623	59	1	1	859.9
624	2	1	1	865.9
625	4	1	1	851.2
626	5	1	1	845.5
627	Dry bed of stream	1	1	844.3
628	Station 6	1	1	870.0
629	7	1	1	895.8
630	9	1	1	894.6
631	13	1	1	903.2
632	Camp 18, head of Bog. river	3	1	917.3
633	Ravine bet. stations 14 & 15	1	1	903.1
634	Station 15	1	1	902.3
635	17	1	1	915.0
636	19	1	1	914.3
637	20	1	1	900.0
638	22	1	1	948.8
639	23	1	1	970.5
640	24	1	1	942.8
641	25	1	1	978.0
642	Ravine between 25 & 26	1	1	932.3
643	Station 26 + 250 yards	1	1	972.0
644	27	1	1	908.3
645	28	1	1	903.0
646	Ravine	1	1	893.3
647	Station 29	1	1	906.0
648	31	1	1	923.3
649	33	1	1	904.6
650	34	1	1	917.4
651	35	1	1	970.3
652	Bed of stream	1	1	902.1
653	Opposite bank	1	1	901.4
654	Station 37	1	1	900.7
655	Hill-top	1	1	931.5
656	Water's edge	1	1	876.8
657	Station 38	1	1	894.1
658	40	1	1	897.9
659	Top of hill bet. sta. 40 & 41	1	1	928.7
660	Station 41	1	1	936.1
661	42	1	1	985.8
662	43	1	1	972.5
663	1	1	1	958.3
664	Foot of prairie roll	1	1	958.5
665	Station 2	1	1	981.2
666	3	1	1	972.4
667	Water's edge, opp. bank	1	1	977.1
668	Station 7	1	1	1040.3
669	Top of ridge	1	1	1153.0
670	Foot of ridge	1	1	1131.6
671	Station 10	1	1	1223.6
672	11	1	1	1220.2
673	1	1	1	1205.1
674	2	1	1	1176.5
675	3	1	1	1170.4
676	4	1	1	1155.3
677	5	1	1	1162.7
678	Foot of hill	1	1	1152.1
679	Camp 19, branch of Topofki creek.	4	1	1088.3
680	Station 8	1	1	1120.1
681	Top of hill	1	1	1156.4
682	(10 or 0)	1	1	1134.2
683	Water's edge	1	1	1132.7
684	Station 1	1	1	1136.6
685	3	1	1	1175.6
686	4	1	1	1169.6
687	6	1	1	1231.1
688	7	1	1	1211.6
689	8	1	1	1195.7
690	9	1	1	1163.6
691	Top of hill	1	1	1112.6
692	Foot of hill, water's edge	1	1	1064.3
693	Top of hill	1	1	1073.1
694	Branch Topofki creek	1	1	1045.6
695	Bank.	1	1	1057.6
696	9 a. m. observation	1	1	1084.0
697	Station 10	1	1	1152.7
698	11	1	1	1172.8
699	14	1	1	1139.7
700	15	1	1	1153.5
701	16	1	1	1159.2
702	18	1	1	1110.0
703	Dry bed of creek	1	1	1093.7
704	Station 19	1	1	1106.1
705	21	1	1	1135.2
706	22	1	1	1158.9
707	24	1	1	1132.2
708	25	1	1	1083.9
709	Water's edge	1	1	1075.1
710	Station 26	1	1	1103.4
711	Ravine	1	1	1100.1
712	Station 30	1	1	1149.9
713	33	1	1	1133.1
714	Bank of creek	1	1	1093.8
715	Bed of creek	1	1	1088.7
716	Opposite bank	1	1	1094.5
717	Station 35	1	1	1095.0
718	36	1	1	1125.7
719	43	1	1	1093.6
720	Top of bank	1	1	1066.9
721	Water's edge	1	1	1052.8
722	Sta. 46, top of sand-bank	1	1	1066.6
723	Station 48	1	1	1071.4
724	49	1	1	1141.9
725	Top of hill	1	1	1129.6
726	Between stations 53 & 54	1	1	1147.9
727	Top of hill	1	1	1157.2
728	Ravine	1	1	1153.0
729	Top of rolling prairie	1	1	1165.0
730	In ravine	1	1	1135.6
731	In gully	1	1	1126.6
732	Station 56	1	1	1185.4
733	In gully	1	1	1159.6
734	Station 57	1	1	1176.1
735	High point	1	1	1174.3
736	Camp 20, Topofki creek	2	1	1151.8
737	Ravine bet. 0 & station 1	1	1	1124.0
738	Bet. sta. 1&2 — Hill-top	1	1	1144.8
739	Bet. sta. 1&2 — Dry bed of stream	1	1	1078.3
740	Bet. sta. 1&2 — Top of hill	1	1	1151.3
741	Bet. sta. 1&2 — Ravine	1	1	1160.3
742	Bet. sta. 1&2 —	1	1	1179.3
743	Top of hill, station 2	1	1	1202.8
744	Bottom of hill	1	1	1167.8
745	Dry bed of stream	1	1	1123.8
746	Top of bank, station 3	1	1	1142.8
747	Top of hill	1	1	1197.8
748	Ravine	1	1	1184.3
749	Station 4	1	1	1206.9

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
750	Station 5	1	1	1204.3	816	Bank of creek	1	1	1267.4
751	6	1	1	1207.1	817	Station 28	1	1	1396.1
752	7	1	1	1214.4	818	30	1	1	1443.3
753	8	1	1	1194.7	819	Camp 25, Walnut creek	3	1	1440.3
754	9	1	1	1197.5	820	Station 1	1	1	1452.1
755	12	1	1	1123.8	821	Between stations 7 and 8	1	1	1510.7
756	13	1	1	1171.6	822	Stations 14 & 15, in gully	1	1	1478.4
757	15	1	1	1183.4	823	Station 20	1	1	1528.9
758	Ravine	1	1	1148.2	824	22	1	1	1504.7
759	Top of hill	1	1	1164.6	825	Stations 26, 29, ravine	1	1	1491.3
760	----------	1	1	1149.4	826	29, 30	1	1	1473.4
761	Station 16	1	1	1182.8	827	31	1	1	1509.5
762	17	1	1	1193.7	828	35	1	1	1483.0
763	Bottom of hill	1	1	1112.8	829	Camp 26, Branch creek	3	1	1402.2
764	Station 18	1	1	1051.7	830	Station 2 to 3, top of hill	1	1	1409.7
765	19	1	1	1105.8	831	3	1	1	1408.2
766	Water's edge	1	1	1056.4	832	4	1	1	1420.2
767	Camp 21, Beaversville	82	2	1083.1	833	4 to 5, gully	1	1	1349.4
768	Station 2	1	1	1133.0	834	6	1	1	1426.2
769	4	1	1	1120.8	835	11 a. m	1	1	1385.4
770	6	1	1	1130.2	836	Bet. stations 17 and 18	1	1	1455.9
771	Foot of slope	1	1	1087.0	837	Station 18	1	1	1450.9
722	Station 7	1	1	1100.9	838	Ravine bet. sta's 19 & 20	1	1	1374.7
773	8	1	1	1115.7	839	Station 23	1	1	1502.1
774	9	1	1	1129.6	840	Foot of hill, sta. 23 to 24	1	1	1437.6
775	Ravine	1	1	1099.5	841	Station 25	1	1	1408.2
776	High bank, station 10	1	1	1114.2	842	29	1	1	1432.8
777	Station 10 to 19, a. m	1	1	1141.6	843	34	1	1	1452.9
778	Station 13	1	1	1152.8	844	Camp 27, Deer creek	3	1	1392.0
779	14	1	1	1141.5	845	Station 2	1	1	1370.8
780	15	1	1	1193.2	846	4	1	1	1471.1
781	Gully	1	1	1172.9	847	Ravine	1	1	1412.9
782	Station 16	1	1	1193.1	848	Station 6	1	1	1517.7
783	Gully	1	1	1186.3	849	11	1	1	1599.2
784	Station 18	1	1	1202.0	850	Between hills	1	1	1630.2
785	----------	1	1	1190.0	851	12 m., stations 15 to 16	1	1	1715.2
786	21	1	1	1111.9	852	Station 24 to 25	1	1	1731.7
787	Ravine	1	1	1132.1	853	Camp 28, Deer ck. spring	4	1	1691.8
788	12 m., station 23	1	1	1129.8	854	Station 1	1	1	1746.2
789	24	1	1	1168.0	855	Between stations 1 and 2	1	1	1724.1
790	27	1	1	1205.3	856	Station 2	1	1	1747.9
791	28	1	1	1221.0	857	4	1	1	1730.3
792	29	1	1	1186.3	858	Foot of slope	1	1	1708.2
793	32	1	1	1205.6	859	Top of ridge	1	1	1741.0
794	Camp 22, Little creek	4	1	1199.2	860	Top of hill, station 5	1	1	1780.1
795	Hill-top	1	1	1228.2	861	Station 6	1	1	1786.8
796	Station 5 to 6	1	1	1198.7	862	9 a. m	1	1	1764.7
797	9	1	1	1182.7	863	Foot of slope	1	1	1737.2
798	15	1	1	1217.1	864	High prairie hill, sta. 8	1	1	1790.8
799	16	1	1	1192.1	865	Foot of slope	1	1	1746.2
800	Hill-top, station 19	1	1	1235.5	866	Lower point	1	1	1743.8
801	Station 20 to 21	1	1	1201.5	867	Station 9	1	1	1761.3
802	22	1	1	1248.5	868	Foot of slope	1	1	1732.9
803	27	1	1	1263.1	869	Station 10	1	1	1817.9
804	Camp 23, br. Walnut ck.	5	1	1223.1	870	----------	1	1	1816.5
805	Station 2	1	1	1198.2	871	Station 12	1	1	1800.7
806	Gully bet. stations 7 & 8	1	1	1128.3	872	13	1	1	1785.8
807	Station 10	1	1	1257.3	873	Ravine	1	1	1756.5
808	15	1	1	1206.3	874	Station 14	1	1	1772.2
809	17	1	1	1229.1	875	15	1	1	1774.4
810	Bet. stations 19 and 20	1	1	1163.7	876	16	1	1	1758.5
811	Camp 24, Walnut creek	3	1	1136.9	877	18 to 19, 3 p. m	1	1	1783.0
812	Station 1 + 1000 feet	1	1	1222.4	878	Camp 29, Nat'l Mound ck.	3	1	1735.5
813	Sta. 2 to 3, bet. hills	1	1	1208.9	879	$\frac{1}{3}$ dist. fm. sta. 1 to sta. 2.	1	1	1759.2
814	Sta. 8 to 9, foot of hill	1	1	1215.2	880	9 a. m., station 2	1	1	1764.0
815	Station 13, + 700 feet	1	1	1269.2	881	Gully	1	1	1718.4

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
882	High point on table-land	1	1	1758.4	947	Hollow in adv. of sta. 21	1	1	2083.1
883	Station 4	1	1	1784.8	948	3 p. m., station 23	1	1	2093.6
884	Top of hill, station 6	1	1	1821.1	949	Hollow	1	1	2050.6
885	Station 7	1	1	1790.8	950	Divide, station 27	1	1	2341.0
886	Ravine	1	1	1761.4	951	In hollow, foot of hill between stations 31 & 32	1	1	2205.9
887	12 m., station 7 to 8	1	1	1784.2					
888	Station 8	1	1	1817.8	952	Camp 34, Epsom spring	3	1	2171.4
889	Foot of hill, station 9	1	1	1824.4	953	Bed of creek	1	1	2159.7
890	Slope, station 10	1	1	1826.5	954	Station 2	1	1	2188.5
891	Top of hill, station 11	1	1	1819.6	955	4	1	1	2073.3
892	Station 12	1	1	1817.2	956	5, 9 a. m	1	1	2105.7
893	Ravine	1	1	1796.8	957	6	1	1	2178.6
894	Station 14	1	1	1794.4	958	7	1	1	2063.4
895	3 p. m., station 15	1	1	1756.0	959	Canadian valley, station 8	1	1	2064.3*
896	Camp 30, Gypsum creek	3	1	1710.9	960	12 m., station 11 + ½ mile	1	1	2150.7
897	Station 2	1	1	1727.8	961	Station 12	1	1	2156.0
898	Water's edge	1	1	1620.5	962	Ravine	1	1	2131.6
899	Station 4	1	1	1751.7	963	Station 16	1	1	2226.7
900	Foot of hill	1	1	1694.8	964	17	1	1	2191.5
901	Station 5	1	1	1750.4	965	Camp 35, Sweet Water run	10	1	2214.8
902	Water's edge, bet. st. 6 & 7	1	1	1571.1	966	Top of hill, station 1	1	1	2268.5
903	Top of hill, station 7	1	1	1644.7	967	9 a. m., sta. 1 + ¼ mile	1	1	2244.7
904	Water's edge, sta. 9 & 10	1	1	1577.9	968	Foot of hill	1	1	2182.2
905	Station 10	1	1	1642.5	969	Station 2	1	1	2314.1
906	4 p. m., station near 11	1	1	1594.6	970	Foot of Antelope Hills	1	1	2418.1
907	Camp 31, Comet creek	3	1	1614.0	971	Top of hill, station 3	1	1	2500.6
908	Top of hill, station 1 to 2	1	1	1699.8	972	Highest point + 200 yds	1	1	2524.5
909	Station 2	1	1	1691.1	973	Station 5	1	1	2489.0
910	High point	1	1	1767.0	974	12 m., station 5 + 1 mile	1	1	2427.4
911	High point, station 7 to 8	1	1	1749.3	975	Top of hill, station 6	1	1	2427.0
912	Water's edge	1	1	1702.8	976	Station 9	1	1	2431.5
913	12 m., ¼ adv. station 9	1	1	1772.4	977	10	1	1	2296.1
914	Station 11	1	1	1794.3	978	Top of table-land, sta. 16	1	1	2281.3
915	14	1	1	1829.7	979	Station 17	1	1	2217.9
916	3 p. m., sta. 15 + 1 mile	1	1	1866.0	980	19	1	1	2230.1
917	Bank of creek, station 18	1	1	1786.2	981	3 p. m, station 21	1	1	2261.2
918	Camp 32, Silver creek	3	1	1802.7	982	Gully	1	1	2202.3
919	Top of hill, station 2	1	1	1842.8	983	Gully, station 22	1	1	2183.9
920	Ravine, station 4	1	1	1827.0	984		1	1	2174.5
921	Top of hill, station 5	1	1	1830.0	985	Station 25	1	1	2156.1
922	On creek	1	1	1684.7	986	26	1	1	2155.7
923	9 a. m., station 8	1	1	1819.3	987	Camp 36, Canadian river	3	1	2162.6
924	Highest point	1	1	1827.9	988	Station 1	1	1	2207.6
925	Station 9,	1	1	1808.6	989	Station 1 + 1¼ miles	1	1	2212.6
926	Water's edge, sta. 13 & 14	1	1	1680.2	990	Foot of hill	1	1	2187.6
927	Top of hill, station 15	1	1	1752.0	991		1	1	2252.6
928	Station 16	1	1	1791.4	992	Station 3	1	1	2137.6
929	17	1	1	1702.7	993	9 a. m, bet. stations 3 & 4	1	1	2147.6
930	Water's edge	1	1	1697.7	994	Top table-land, station 5	1	1	2246.3
931	3 p. m., station 19	1	1	1783.6	995	In water-course	1	1	2151.4
932	Camp 33, Oak creek	2	1	1748.3	996	Station 8	1	1	2214.0
933	Station 3	1	1	1877.6	997	In water-course	1	1	2192.0
934	3 + 1 mile	1	1	1930.4	998	Station 9	1	1	2205.1
935	7	1	1	1995.8	999	10	1	1	2276.7
936	11	1	1	1845.2	1000	In sandy bed	1	1	2258.3
937	12	1	1	1838.6	1001	12 m., station 11	1	1	2307.4
938	14	1	1	1927.4	1002	In sandy bed	1	1	2235.9
939	Between hills	1	1	1937.0	1003	Top of prairie	1	1	2321.9
940	Station 15, top of hill	1	1	2005.1	1004	Station 16	1	1	2215.3
941	16	1	1	2032.7	1005	18	1	1	2319.3
942	17	1	1	2033.3	1006	Ravine	1	1	2248.7
943	18	1	1	2033.9	1007	3 p. m., station 23	1	1	2307.7
944	Hollow bet. sta. 18 & 19	1	1	2016.5	1008	Camp 37, mo. of Wolf cr	3	1	2319.1
945	Highest pt. of ridge between stations 19 & 20	1	1	2089.1	1009	Station 1	1	1	2378.2
					1010	Dry ravine	1	1	2359.9
946	2 p. m., bet. stas. 20 & 21	1	1	2125.7	1011	9 a. m., station 4	1	1	2396.5

* Fall of river, from this point to Shawnee villages, at the rate of five feet per mile.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1012	Ravine	1	1	2356.6	1072	Station 14	1	1	3041.0
1013	Bed of river	1	1	2322.1	1073	15	1	1	3094.1
1014	12 m., station 16	1	1	2381.2	1074	3 p. m., station 19+½ mile	1	1	3202.1
1015	Top of hill-slope, sta. 17	1	1	2433.8	1075	Station 20	1	1	3243.5
1016	Station 19	1	1	2447.0	1076	21	1	1	3275.9
1017	Valley	1	1	2450.3	1077	Ht. pt., station 22—½ mile	1	1	3219.2
1018	Station 21	1	1	2468.0	1078	6 p. m., station 25	1	1	3146.3
1019	Dry water-course	1	1	2462.3	1079	Camp 42, White Sandy ck.	8	1	3184.1
1020	Top of spur, station 24	1	1	2476.0	1080	Station 1	1	1	3257.7
1021	Station 27	1	1	2465.8	1081	2	1	1	3326.8
1022	In water	1	1	2479.0	1082	4	1	1	3321.2
1023	3 p. m., station 30	1	1	2504.8	1083	Ht. pt., bet. stations 4 & 5	1	1	3332.7
1024	Station 32	1	1	2493.7	1084	Gully, station 5 to 6	1	1	3294.7
1025	38	1	1	2489.8	1085	Top of hill	1	1	3318.8
1026	Camp 38, mo. of Wine ck.	3	1	2454.4	1086	12 m., station 11	1	1	3388.8
1027	Station 2	1	1	2434.3	1087	Half-way, station 11 to 12	1	1	3364.9
1028	9 a. m., station 4	1	1	2433.8	1088	Gully	1	1	3319.4
1029	Station 5	1	1	2420.0	1089	Dry sand-bed	1	1	3273.0
1030	8	1	1	2402.7	1090	3 p. m., station 18	1	1	3254.5
1031	In valley	1	1	2411.4	1091	Camp 43, Shady creek	3	1	3264.6
1032	Station 11	1	1	2448.9	1092	Top of spur	1	1	3381.2
1033	12	1	1	2437.8	1093	Gully bet. sta. 3 & 4, 9 a. m.	1	1	3380.8
1034	16	1	1	2487.1	1094	Station 7	1	1	3429.9
1035	12 m., station 16+½ mile	1	1	2491.2	1095	8	1	1	3488.9
1036	Station 18	1	1	2509.9	1096	In gully	1	1	3426.4
1037	In water	1	1	2487.1	1097	Bed of creek	1	1	3390.9
1038	Camp 39, mo. of Valley riv.	4	1	2505.5	1098	12 m., station 13	1	1	3490.4
1039	Bed of river, bet. stations 3 & 4.	1	1	2478.0	1099	Station 14	1	1	3518.8
					1100	Arroyo Amarillo, sta. 16	1	1	3403.2
1040	Station 7	1	1	2513.5	1101	Station 20	1	1	3536.0
1041	9	1	1	2531.0	1102	3 p. m., station 22	1	1	3500.5
1042	12 m., station 13	1	1	2547.6	1103	Gully	1	1	3526.2
1043	Station 17	1	1	2566.1	1104	Top of hill	1	1	3515.9
1044	25	1	1	2642.2	1105	Gully	1	1	3460.6
1045	26	1	1	2645.3	1106	Cp. 44, Beautiful View cr.	3	1	3404.7
1046	27	1	1	2657.4	1107	Lowest pt. bet. steep banks	1	1	3391.1
1047	120 yards back from station 30.	1	1	2679.4	1108	Low point	1	1	3427.5
					1109	Station 3	1	1	3518.9
1048	Station 31	1	1	2670.8	1110	5	1	1	3524.3
1049	Camp 40, near mouth of Spring creek.	3	1	2677.8	1111	Top of mesa	1	1	3570.7
					1112	Ravine, station 7 to 8	1	1	3497.1
1050	Station 3	1	1	2654.2	1113	Station 8	1	1	3533.5
1051	9 a. m.	1	1	2695.4	1114	9 a. m., bet. sta. 8 and 9	1	1	3543.9
1052	Station 7	1	1	2691.0	1115	Station 11	1	1	3530.3
1053	8	1	1	2725.0	1116	12	1	1	3596.8
1054	10	1	1	2750.9	1117	Gully	1	1	3588.2
1055	Water's edge	1	1	2731.8	1118	Station 15	1	1	3649.5
1056	Station 12	1	1	2757.7	1119	Ravine	1	1	3625.9
1057	12 m.	1	1	2770.1	1120	Ravine, station 17	1	1	3677.3
1058	Station 18	1	1	2814.9	1121	Highest point, station 19	1	1	3753.7
1059	Top of hill, station 21	1	1	2875.0	1122	3 p. m., station 20	1	1	3804.1
1060	Station 24	1	1	2791.1	1123	Camp 45, Rincon de la Cruz	3	1	3777.9
1061	27	1	1	2826.9	1124	Station 2	1	1	3885.5
1062	3 p. m., station 28	1	1	2816.8	1125	4	1	1	3953.0
1063	In sandy gully	1	1	2822.0	1126	5	1	1	3919.6
1064	Top of hill	1	1	2906.4	1127	7	1	1	3936.1
1065	Foot of hills	1	1	2844.1	1128	9 a. m., station 12, Encampment creek.	1	1	3828.7
1066	Camp 41, Canadian river*	2	1	2846.9					
1067	Station 1	1	1	2795.2	1129	12 m., station 15	1	1	4018.2
1068	9 a. m., station 2	1	1	2824.0	1130	Station 16	1	1	3990.8
1069	Station 8	1	1	2836.6	1131	17	1	1	4013.3
1070	Gully	1	1	2853.7	1132	18	1	1	3985.9
1071	12 m., station 10	1	1	2884.3	1133	19	1	1	4008.4

* Fall of river from camp 41 to camp 34, seven feet per mile.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observationsatstation.	No. of barometers used.	Height, in feet, above mean tide.
1134	Station 20	1	1	4031.0	1198	Station 8	1	1	4605.8
1135	Ravine	1	1	4023.5	1199	9	1	1	4622.0
1136	3 p. m., station 22	1	1	4027.1	1200	10	1	1	4613.6
1137	Dry bed of creek	1	1	4007.6	1201	3 p. m., station 16	1	1	4590.2
1138	Station 23	1	1	3988.2	1202	Camp 50, Laguna Colorada	3	1	4587.5
1139	25	1	1	4069.7	1203	Station 1	1	1	4637.3
1140	26	1	1	4038.3	1204	3	1	1	4727.1
1141	Camp 46, Rocky Dell crk.	8	1	3931.8	1205	4	1	1	4774.9
1142	Prairie, station 3	1	1	3982.1	1206	5	1	1	4771.7
1143	Ravine, bet. sta. 4 and 5	1	1	3932.4	1207	9 a. m., station 6	1	1	4780.5
1144	Station 6	1	1	4055.7	1208	Dry water-course, from station 8 to 9.	1	1	4667.3
1145	10 a. m	1	1	4009.0					
1146	Station 8	1	1	3957.3	1209	Station 11	1	1	4724.1
1147	10	1	1	3935.6	1210	13	1	1	4661.9
1148	14	1	1	4033.9	1211	Water in Laguna, sta. 14	1	1	4637.7
1149	12 m	1	1	4053.2	1212	12 m	1	1	4774.5
1150	Top of hill	1	1	4033.5	1213	Station 16	1	1	4748.3
1151	Station 15	1	1	4002.8	1214	17	1	1	4842.1
1152	16	1	1	4017.0	1215	3 p. m	1	1	4875.9
1153	19	1	1	3997.3	1216	Station 18	1	1	4869.7
1154	3 p. m , station 21	1	1	3896.6	1217	Water-course	1	1	4803.5
1155	Station 22	1	1	3921.8	1218	Camp 51, Arroyo Cuerbito	3	1	4848 4
1156	Cp. 47, Cañada de Truxillo	5	1	3938.0	1219	In bed of creek	1	1	4879.8
1157	Ht. pt., station 2	1	1	3950.4	1220	Top of hill, station 2	1	1	5021.2
1158	In water, 2 to 3, Halt creek	1	1	3937.8	1221	9 a. m	1	1	5047.6
1159	Station 4	1	1	3950.2	1222	Station 5	1	1	5056.0
1160	12 m., station 5	1	1	3963.6	1223	7	1	1	5099.4
1161	Station 6	1	1	3961.0	1224	13	1	1	4992.8
1162	7	1	1	4037.4	1225	12 m., station 14	1	1	5051.2
1163	Ravine	1	1	4014.8	1226	In bed of creek	1	1	4987.6
1164	Station 9	1	1	4056.2	1227	Top of bank, station 17	1	1	5024.0
1165	3 p. m	1	1	4071.6	1228	Camp 52, Hurrah creek	9	1	5047.0
1166	In water	1	1	4117.0	1229	Station 2	1	1	5116.3
1167	Gully	1	1	4172.4	1230	In Rocky creek	1	1	5210.6
1168	Station 10	1	1	4182.8	1231	Station 4	1	1	5479.9
1169	11	1	1	4253.2	1232	6	1	1	5441.2
1170	12	1	1	4237.6	1233	7	1	1	5485.5
1171	13	1	1	4213.1	1234	9 a. m., station 8	1	1	5514.8
1172	Ravine, station 13 to 14	1	1	4158.6	1235		1	1	5496.1
1173	Station 15	1	1	4174.0	1236	Station 9	1	1	5512.4
1174	16	1	1	4205.6	1237	Rio Gallinas, station 15	1	1	5308.7
1175	Camp 48, br. of Fossil cr	2	1	4125.2	1238	Station 17	1	1	5425.0
1176	Station 1	1	1	4141.4	1239	12 m	1	1	5436.3
1177	Br. Fossil cr., 9 a. m., st. 2	1	1	4070.6	1240	Camp 53, Chuponas spr'gs	4	1	5463.6
1178	Top of bank	1	1	4114.8	1241	Plain of Las Chuponas	1	1	5448.1
1179	Station 3	1	1	4111.0	1242	Do. do.	1	1	5492.6
1180	In water of Fossil creek	1	1	4033.2	1243	Station 2, ridge	1	1	5632.1
1181	Station 7	1	1	4094.4	1244	5	1	1	5501.6
1182	8	1	1	4166.6	1245	9 a. m., station 5	1	1	5480.1
1183	12 m., station 10	1	1	4250.8	1246	Station 6	1	1	5347.6
1184	Station 11, bed of Tucumcari creek, 1st branch.	1	1	4153.0	1247	Bed of river Pecos	1	1	5320.1
					1248	Camp 54, Anton Chico	11	1	5372.8
1185	Station 12	1	1	4173.4	1249	Station 1	1	1	5396.5
1186	Sta. 13, bed of cr., 2d br.	1	1	4168.6	1250	9 a. m., station 2	1	1	5456.2
1187	Station 14	1	1	4181.8	1251	Hill, stations 3 to 4	1	1	5564.9
1188	18	1	1	4215.0	1252	Station 5	1	1	5638.6
1189	Camp 49, Tucumcari cr'k.	3	1	4262.4	1253	6	1	1	5711.3
1190	Ravine	1	1	4300.0	1254	On hill, station 7	1	1	5753.0
1191	Station 2	1	1	4337.6	1255	Station 8	1	1	5809.7
1192	9 a. m., station 3	1	1	4404.2	1256	9	1	1	5870.4
1193	Station 4	1	1	4431.8	1257	10	1	1	5860.1
1194	5	1	1	4476.4	1258	Highest point, station 11	1	1	5939.8
1195	Water pool, station 6	1	1	4441.0	1259	12 m., station 12	1	1	5918.5
1196	Station 7	1	1	4482.6	1260	Station 13	1	1	5947.2
1197	12 m	1	1	4520.2	1261	14	1	1	5960.9

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1262	Station 16	1	1	6144.6	1324	Hollow, 500 yards back of station 10.	1	1	6460.3
1263	17	1	1	6078.3					
1264	Ht. pt., st. 19, + 200 yds	1	1	6122.0	1325	Station 10	1	1	6473.2
1265	Station 22	1	1	6220.7	1326	Hollow	1	1	6461.9
1266	Valley, station 23	1	1	6239.4	1327	Top of hill, station 11	1	1	6517.7
1267	Station 24	1	1	6328.1	1328	Station 12	1	1	6510.8
1268	25	1	1	6332.8	1329	+ ½ mile bet. 12 and 13	1	1	6655.7
1269	29	1	1	6423.5	1330	+ 200 yards	1	1	6607.0
1270	30	1	1	6394.2	1331	+ 300 yards	1	1	6617.7
1271	Bed of water-course	1	1	6303.9	1332	Station 14	1	1	6720.8
1272	Camp 55, Cañon Blanco	2	1	6320.0	1333	15, 3 p. m	1	1	6629.3
1273	Station 2	1	1	6328.0	1334	+ ¾ mile	1	1	6555.3
1274	9 a. m., station 4	1	1	6380.0	1335	Small hill, station 16	1	1	6469.2
1275	Station 5	1	1	6367.0	1336	+ ¼ mile	1	1	6450.2
1276	7	1	1	6349.0	1337	Station 17	1	1	6397.3
1277	8	1	1	6412.0	1338	Village, station 18	1	1	6400.6
1278	Valley, station 9	1	1	6461.0	1339	Camp 58, San Antonio	3	1	6408.8
1279	Valley, station 10	1	1	6519.0	1340	+ ¼ mile in hollow	1	1	6312.3
1280	Valley, station 11, 12 m	1	1	6541.0	1341	Station 1	1	1	6325.2
1281	Station 12	1	1	6569.0	1342	+ ¼ mile, high point	1	1	6287.7
1282	Highest point, station 17	1	1	6943.0	1343	+ 200 yards	1	1	6221.9
1283	Camp 56, Laguna Blanca	5	2	6796.3	1344	Station 2	1	1	6183.4
1284	+ ½ mile	1	1	6738.0	1345	3, 9 a. m	1	1	6038.8
1285	¼ mile back from ×	1	1	6795.2	1346	+ ¼ mile	1	1	5984.5
1286	×	1	1	6764.4	1347	Station 4	1	1	5977.5
1287	+ ½ mile	1	1	6777.6	1348	5	1	1	5949.5
1288	+ 800 feet	1	1	6746.8	1349	+ ¼ mile	1	1	5922.5
1289	Station 1	1	1	6754.5	1350	Station 6	1	1	5899.7
1290	+ ⅓ mile	1	1	6701.7	1351	7	1	1	5830.7
1291	+ ¼ mile	1	1	6731.4	1352	8	1	1	5744.9
1292		1	1	6695.1	1353	9	1	1	5751.5
1293	Highest point	1	1	6768.8	1354	10	1	1	5852.9
1294		1	1	6518.0	1355	11	1	1	5550.5
1295	Station 2	1	1	6523.5	1356	12	1	1	5383.9
1296	299, rev. beyond station 2	1	1	6528.9	1357	13	1	1	5286.6
1297	Undulating prairie	1	1	6477.3	1358	14	1	1	5277.5
1298	Do	1	1	6411.3	1359	¼ mile back of station 15	1	1	5206.4
1299	+ ¾ mile	1	1	6372.8	1360	+ 250 yards	1	1	5219.3
1300	Station 3	1	1	6306.8	1361	Station 15	1	1	5206.0
1301	+ ⅓ mile	1	1	6279.3	1362	16	1	1	5197.9
1302		1	1	6306.8	1363	+ 1 mile in acequia	1	1	5016.6
1303		1	1	6245.2	1364	Station 17, 3 p. m	1	1	5024.2
1304	Top of hill, station 4	1	1	6273.8	1365	18	1	1	5021.4
1305	Hollow	1	1	6235.3	1366	19	1	1	5023.8
1306	+ 150 yards	1	1	6255.1	1367	Camp 59, Albuquerque	254	2	5026.1
1307	+ 1 mile	1	1	6221.0	1248	Anton Chico*	11	1	5372.8
1308	Station 7	1	1	6229.8	1368	+ 4 miles, top of hill	1	1	5789.2
1309	Camp 57, San Pedro Pass	3	1	6251.1	1369	+ 8 miles, 3d summit, near Cañon Blanco.	1	1	6111.9
1310	+ ¾ mile	1	1	6275.0					
1311	+ 890 rev., 9 a. m	1	1	6373.8	1370	Valley at La Cuesta	1	1	5792.1
1312	+ ⅓ mile	1	1	6381.2	1371	Top of measa on edge of bluff overlooking the valley.	2	1	6308.6
1313	Station 1	1	1	6382.0					
1314	2	1	1	6419.1					
1315	+ ¼ mile in hollow	1	1	6413.3	1283	Camp 56, Laguna Blanca	5	2	6796.3
1316	+ ½ mile	1	1	6445.0	1372	Station 5	1	1	6790.8
1317	Station 3	1	1	6416.1	1373	6	1	1	6419.4
1318	+ ¼ mile, highest point	1	1	6449.9	1374	Valley, station 7	1	1	6384.3
1319	+ ⅔ mile, hollow	1	1	6459.5	1375	Head branch of Galisteo	1	1	6165.3
1320	Station 7, 12 m.	1	1	6640.7	1376	Galisteo village	3	1	5913.4
1321	8	1	1	6543.6	1377	Los Cerrillos	2	1	5804.6
1322	Lowest point, + ¼ mile	1	1	6534.6	1378	Peña Blanca†	1	1	5288.6
1323	Hill, station 9	1	1	6547.5	1379	Mouth of Rio Galisteo‡	1	1	5241.8

* Results derived from a reconnoissance from Anton Chico, *via* Galisteo, to Albuquerque.
† Rate of fall of Rio del Norte from Peña Blanca to Albuquerque, 37 miles, $6\frac{7}{10}$ feet per mile.
‡ Rate of fall of Rio del Norte from mouth of Rio Galisteo to Albuquerque, 33 miles, 6.4 feet per mile.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1380	Santo Domingo, bank of Del Norte.*	2	1	5191.2
1381	San Felipe, station 2, 50 feet above river.†	1	1	5220.8
1382	Station 3, top of bluff bank	1	1	5366.0
1383	Zandia‡	2	1	5056.3
1367	Albuquerque	254	2	5026.1
1399	Isleta§	2	2	4946.6
1367	Camp 59, Albuquerque	254	2	5026.1
1384	Camp 60, Atrisco	------	1	5033.1
1385	Acequia bridge, station 1	1	1	5044.6
1386	Station 2	1	1	5042.2
1387	5	1	1	5023.8
1388	6	1	1	5021.4
1389	Bar. sta	1	1	5000.0
1390	Bar. sta	1	1	5087.6
1391	Station 8	1	1	4960.2
1392	Bridge of acequia	1	1	4966.8
1393	----------	1	1	4967.4
1394	Station 9	1	1	4945.0
1395	----------	1	1	4938.6
1396	Station 10	1	1	4917.2
1397	11	1	1	4907.8
1398	13	1	1	4931.4
1399	Isleta magnetic station	2	2	4946.6
1400	Station 14	1	1	4956.6
1401	15	1	1	4985.6
1402	Camp 61, on river bank, near Isleta.	3	1	4909.6
1403	Bar. sta	1	1	4952.5
1404	+ ¼ mile	1	1	4938.1
1405	Station A	1	1	5013.6
1406	1	1	1	5069.7
1407	1 + ½ mile	1	1	5018.6
1408	Top of bluff, bar. sta	1	1	5052.4
1409	Bar. sta	1	1	5061.0
1410	Station C	1	1	5082.2
1411	E	1	1	5280.9
1412	E + 100 yards	1	1	5264.3
1413	2	1	1	5284.4
1414	2, + 800 feet, F.	1	1	5273.1
1415	F, + ½ mile, G	1	1	5335.2
1416	H, 3 p. m	1	1	5403.6
1417	I	1	1	5377.7
1418	K	1	1	5425.1
1419	3	1	1	5550.2
1420	3, + ½ mile	1	1	5518.9
1421	4, halt	1	1	5575.9
1422	Camp 62, Rio Puerco‖	2	1	5222.3
1423	Rio Puerco, in bed of river	1	1	5192.7
1424	Top west bank	1	1	5210.3
1425	Station A	1	1	5269.9
1426	2	1	1	5326.3
1427	3	1	1	5472.0
1428	6, highest point	1	1	5647.1
1429	7, still higher	1	1	5681.5
1430	8, +100 yds., the very highest pt.	1	1	5705.4
1431	Station 11	1	1	5612.6
1432	12	1	1	5560.1
1433	13	1	1	5610.3
1434	14, top of hill	1	1	5634.2
1435	15	1	1	5652.9
1436	Sandy hollow	1	1	5619.1
1437	Station 16	1	1	5646.1
1438	D	1	1	5575.5
1439	17	1	1	5617.2
1440	E	1	1	5616.9
1441	18	1	1	5642.9
1442	Between stations 18 & 19	1	1	5632.1
1443	Station F	1	1	5677.5
1444	Camp 63, near ruins, Rita	14	1	5556.3
1445	Station 3, top bank of riv.	1	1	5533.9
1446	In bed of river	1	1	5575.7
1447	Station 5	1	1	5587.5
1448	7	1	1	5622.9
1449	9, + 100 yards	1	1	5701.9
1450	9 a. m. C	1	1	5777.7
1451	Station 11	1	1	5700.3
1452	12, — 100 yards	1	1	5655.4
1453	14	1	1	5739.6
1454	17	1	1	5712.6
1455	18	1	1	5706.6
1456	19	1	1	5740.5
1457	20	1	1	5774.3
1458	22	1	1	5822.8
1459	E	1	1	5890.2
1460	25	1	1	5843.2
1461	27	1	1	5874.9
1462	Camp 64, Covero	4	1	5879.8
1463	Station 3	1	1	5930.7
1464	4	1	1	5924.4
1465	F	1	1	5880.7
1466	F, + ¼ mile	1	1	5885.4
1467	H	1	1	5841.3
1468	5	1	1	5890.0
1469	6	1	1	5884.6
1470	7 — 20 yards	1	1	5861.8
1471	Station 7	1	1	5878.6
1472	Gully, station K	1	1	5927.3
1473	Station 8	1	1	5955.2
1474	Top of hill, station 9	1	1	5971.0
1475	Station 11	1	1	6015.4
1476	1 p. m.	1	1	6026.8
1477	Station 14	1	1	6032.7
1478	15	1	1	6048.5
1479	17	1	1	6103.9
1480	18	1	1	6103.2
1481	19	1	1	6136.6
1482	Camp 65, Hay camp¶	3	1	6080.9
1483	N. 40° W., 20 miles to Bivouac I.	1	1	6723.4
1484	N. 30° W., 2 miles to Agua Azul.	1	1	6852.5
1485	N. 30° W., 3 miles to near head of Rio del Gallo.	1	1	6874.9

* Rate of fall of Rio del Norte from San Domingo to Albuquerque, 32 miles, 5.3 feet per mile.

† Rate of fall of Rio del Norte, 26 miles, 5.6 feet per mile.

‡ Rate of fall of Rio del Norte, 12 miles, 2.5 feet per mile.

§ Rate of fall of Rio del Norte, 14 miles, 5.4 feet per mile. Mean rate of fall of Rio Grande between Peña Blanca and Isleta, $5\frac{86}{100}$ feet per mile.

‖ The altitude of Camp 62 is deduced from corresponding observations made in the valley of the Rio Grande.

¶ The following data for profile from Hay camp, through Capmbell's pass of the Sierra Madre, to Zuñi, were obtained from observations made with an Aneroid barometer.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1486	W. N. W. 12 miles to summit of Campbell's pass.	1	1	6952.0	1529	Station 4[1]	1	1	‡7871.7
					1530	5[1]	1	1	‡7902.9
1487	W. 6 miles to Laguna Carricito.	1	1	6622.0	1531	6[1]	1	1	‡7940.7
					1532	6[11]	1	1	‡7889.4
1488	Fort Defiance	1	1	6860.0	1533	7[1]	1	1	‡8063.6
1489	Ojo del Poso	1	1	6400.0	1534	8[1]	1	1	‡8006.8
1604	Camp 70, near Pueblo de Zuñi.	158	2	6336.5	1535	9[1]	1	1	‡7925.8
					1536	10[1]	1	1	‡7928.4
1367	Albuquerque*	254	2	5026.1	1537	11[1]	1	1	‡7924.2
1490	Camp 60[1], ran. of Atrisco.		1	5026.1	1527	11	1	1	‡7892.5
1491	Station 1, foot of ridge. valley of Rio Grande.	1	1	5026.1	1538	13 + 100 yards	1	1	7899.9
					1539	14	1	1	7801.7
1492	Station 2, on slope of hill	1	1	5095.4	1540	15	1	1	7789.3
1493	Station 3, foot of steep bluff of ridge.	1	1	5595.2	1541	M	1	1	7772.5
					1542	17	1	1	7752.4
1494	Station 4, top of ridge	1	1	5756.9	1543	18	1	1	7737.8
1495	5, on mesa	1	1	5821.4	1544	K	1	1	7728.7
1496	7, do	1	1	5852.9	1545	I	1	1	7687.7
1497	8, do	1	1	5900.1	1546	20	1	1	7629.1
1498	11, Camp 61[1] on Rio Puereo.		1	5315.3	1547	21	1	1	7570.5
					1548	22	1	1	7528.4
1499	1	1	1	5394.0	1549	L	1	1	7453.3
1500	2	1	1	5443.3	1550	23	1	1	7460.7
1501	4	1	1	5337.3	1551	24	1	1	7451.6
1502	6	1	1	5524.2	1552	25	1	1	7393.0
1503	Camp 62[1], El Alamo, or Sheep's springs.		1	5501.1	1553	26	1	1	7373.9
					1554	3 p. m., station 27	1	1	7398.9
1444	Camp 63, in valley near ruins of Rita.	14	1	5556.3	1555	Station 28	1	1	7392.0
					1556	R	1	1	7375.2
1504	Station 15, top of hill	1	1	5835.6	1557	B	1	1	7327.6
1505	Station 16, on Rio, near Laguna.	1	1	5726.4	1558	29	1	1	7371.3
					1559	30	1	1	7346.8
1506	Camp 63[1], ½ mile W. of Laguna.		1	5732.7	1560	31	1	1	7325.6
					1561	Sunset, station P	1	1	7219.7
1482	Camp 65, Hay camp	1	1	6080.9	1562	Camp 68, El Moro	2	1	7237.8
1507	9 a. m., station 6	1	1	6252.8	1563	Station L	1	1	7214.6
1508	Station H	1	1	6351.0	1564	1	1	1	7195.8
1509	12 m., 13 to 14, station 1	1	1	6439.3	1565	9.30 a. m., station P	1	1	7178.1
1510	Station K	1	1	6589.1	1566	Station Q	1	1	7207.7
1511	Higher pt., station L	1	1	6625.7	1567	2	1	1	7226.3
1512	Station 15	1	1	6771.3	1568	R[1]	1	1	7175.6
1513	16	1	1	6854.2	1569	3	1	1	7229.4
1514	M	1	1	6975.6	1570	R	1	1	7138.0
1515	Camp 66, E. slope of Sierra Madre.	3	1	7031.1	1571	4	1	1	7156.6
					1572	S	1	1	7186.2
1516	Station 1 + 100 yds. top of hill.	1	1	7098.9	1573	5	1	1	7100.3
					1574	K	1	1	7058.4
1517	Sunrise, station 3	1	1	7239.3	1575	N	1	1	7058.3
1518	Station K	1	1	7347.8	1576	T	1	1	7007.6
1519	Betw. 14 & 15, station L.	1	1	7692.8	1577	12 m., station 6	1	1	6986.7
1520	Camp 67, Agua Fria	5	1	7757.1	1578	Station V	1	1	6955.8
1521	Station 2	1	1	7761.2	1579	W	1	1	6917.2
1522	Foot of hill, station 3	1	1	†7864.3	1580	7	1	1	6855.5
1523	Station K	1	1	†7968.5	1581	H	1	1	6766.3
1524	4	1	1	†8076.0	1582	8	1	1	6705.7
1525	7	1	1	†8019.6	1583	S	1	1	6615.5
1526	8	1	1	†8066.6	1584	9	1	1	6597.8
1527	11	1	1	†7892.5	1585	Camp 69, Ojo del Pescado	5	1	6551.5
1522	3, foot of hill	1	1	‡7864.3	1586	Station A	1	1	6581.8
1528	3[1]	1	1	‡7857.0	1587	B	1	1	6596.7

* Data for profile from Albuquerque along the usually travelled road to Pueblo de la Laguna.

† Profile over the crest of the Sierra Madre by following the road.

‡ Data for a profile over the crest of the Sierra Madre by ascending a ravine to the right of station 3, and entering the road at station 11. (See notes of survey.)

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1588	Station 1	1	1	6584.1
1589	2	1	1	6542.9
1590	C	1	1	6549.0
1591	D	1	1	6541.9
1592	F	1	1	6571.1
1593	K	1	1	6555.2
1594	3	1	1	6542.7
1595	L	1	1	6497.2
1596	12 m., station 4	1	1	6455.0
1597	Station M	1	1	6444.7
1598	5	1	1	6439.9
1599	R	1	1	6429.6
1600	6	1	1	6435.8
1601	7	1	1	6411.2
1602	8	1	1	6334.9
1603	9	1	1	6341.1
1604	Camp 70, Zuñi river	158	2	6336.5
1605	Top of mesa, station 1	1	1	6385.5
1606	Station 2	1	1	6339.9
1607	3	1	1	6330.6
1608	4	1	1	6235.5
1609	6	1	1	6260.3
1610	9	1	1	6280.7
1611	N	1	1	6306.6
1612	13	1	1	6342.4
1613	Camp 71, Arch spring	11	1	6350.1
1614	Station 0	1	1	6327.2
1615	1	1	1	6290.0
1616	12 m., station O	1	1	6196.7
1617	Station F	1	1	6138.6
1618	5	1	1	6130.0
1619	K	1	1	6082.9
1620	P	1	1	6129.3
1621	7	1	1	6099.8
1622	3 p. m., station M	1	1	6135.2
1623	Station 8	1	1	6179.4
1624	Camp 72, Cedar Forest	4	1	6162.2
1625	Station L	1	1	6163.3
1626	1	1	1	6218.3
1627	2	1	1	6210.6
1628	3	1	1	6234.8
1629	4	1	1	6320.6
1630	5	1	1	6340.4
1631	M	1	1	6404.2
1632	6	1	1	6371.2
1633	K	1	1	6277.7
1634	7	1	1	6277.7
1635	12 m., 8	1	1	6266.7
1636	Station 9	1	1	6244.7
1637	P	1	1	6222.7
1638	R	1	1	6211.7
1639	S	1	1	6243.6
1640	11	1	1	6304.1
1641	12	1	1	6331.6
1642	13	1	1	6246.3
1643	14	1	1	6132.5
1644	T	1	1	6080.8
1645	W	1	1	6025.8
1646	15	1	1	5958.7
1647	16	1	1	5931.2
1648	Sunset, station V	1	1	5957.6
1649	Station 17	1	1	5981.8
1650	18	1	1	5968.6
1651	Camp 73, Jacob's well	3	1	5973.4
1652	Station A	1	1	5873.5
1653	1	1	1	5901.0
1654	Station 2	1	1	5967.0
1655	B	1	1	5863.6
1656	12 m., station C	1	1	5864.7
1657	Station 3	1	1	5771.2
1658	4	1	1	5699.7
1659	5	1	1	5643.7
1660	Camp 74, Navajo springs	5	1	5665.5
1661	Station 2	1	1	5642.9
1662	3	1	1	5594.3
1663	4	1	1	5562.2
1664	5	1	1	5557.6
1665	12 m., station C	1	1	5564.0
1666	Station 7	1	1	5702.4
1667	K	1	1	5689.0
1668	9	1	1	5715.2
1669	3 p. m., station L	1	1	5662.1
1670	Station P	1	1	5704.9
1671	Bank of river, station 12	1	1	5537.7
1672	Camp 75, Carrizo creek	4	1	5550.1
1673	Station A	1	1	5722.4
1674	12 m., station B	1	1	5713.1
1675	Station 2	1	1	5717.0
1676	5, in bed of str.	1	1	5632.9
1677	6	1	1	5656.6
1678	7	1	1	5732.0
1679	8	1	1	5735.9
1680	9	1	1	5696.9
1681	3 p. m., station K	1	1	5619.4
1682	Camp 76, near Lithodendron creek.	4	1	5499.9
1683	Station 1	1	1	5365.5
1684	12 m., station P	1	1	5338.4
1685	Station 5	1	1	5315.3
1686	6	1	1	5293.2
1687	Mesa, 3 p. m., station 7	1	1	5329.9
1688	Station T	1	1	5266.9
1689	Bed of dry arroyo, st'n V	1	1	5249.0
1690	Station X	1	1	5190.2
1691	8	1	1	5176.4
1692	Sunset, station Z	1	1	5149.1
1693	Camp 77, near Rio Puereo of the west.	8	1	5110.6
1694	Station B	1	1	5180.7
1695	C	1	1	5163.7
1696	D	1	1	5098.4
1697	12 m., station E	1	1	5145.5
1698	Station J	1	1	5160.0
1699	7	1	1	5155.6
1700	P	1	1	5047.3
1701	Dry bed, sta. 8 + 120 yds.	1	1	5032.4
1702	Camp 78, val. of Flax riv.	5	1	5015.7
1703	Station A	1	1	5071.6
1704	B	1	1	5033.1
1705	2	1	1	5083.7
1706	D	1	1	5010.5
1707	3 p. m., station 8	1	1	4923.7
1708	Station 11	1	1	4899.9
1709	E	1	1	4872.9
1710	Camp 79, val. of Flax riv.	3	1	4801.7
1711	Station A	1	1	4815.1
1712	12 m., station B	1	1	4810.7
1713	Station 5	1	1	4762.2
1714	Camp 80, val. of Flax riv.	5	1	4735.8
1715	Station 1	1	1	4770.1
1716	2	1	1	4773.9
1717	3 + 75 yards	1	1	4814.4

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1718	12 m., station 6	1	1	4757.3
1719	Camp 81, val. of Flax riv.	10	2	4760.9
1720	Camp 82, val. of Flax riv.	52	2	4752.3
1721	In bed of Flax riv., sta. A.	------	------	4686.0
1722	Left bank of river, sta. B.	1	1	4738.3
1723	12 m., station 4	1	1	4736.1
1724	Camp 83, val. of Flax riv.	22	2	4675.2
1725	Top of first mesa, sta. A	1	1	4632.0
1726	Station B	1	1	4626.6
1727	2d mesa, station C	1	1	4653.7
1728	12 m., foot of mesa, sta. 2.	1	1	4614.7
1729	Top of 3d mesa, station 4	1	1	4641.8
1730	Top of 4th mesa, station 5.	1	1	4649.0
1731	Camp 84, val. of Flax riv.	10	2	4618.3
1732	Top of 1st mesa, station 1.	1	1	4691.7
1733	Station B	1	1	4742.0
1734	C	1	1	4687.3
1735	3	1	1	4636.8
1736	4	1	1	4606.3
1737	3 p. m., station 7	1	1	4583.1
1738	Station 11	1	1	4598.7
1739	Camp 85, val. of Flax riv.	38	2	4594.3
1740	Bed of arroyo, 12 m., sta. A.	1	1	4579.4
1741	Top of 1st mesa, sta. B	1	1	4688.4
1742	Station 1	1	1	4645.0
1743	2	1	1	4644.8
1744	4	1	1	4566.8
1745	Camp 86, val. of Flax riv.	10	2	4569.5
1746	Camp 87, last, Flax riv. val.	23	2	4597.1
1747	Station 2	1	1	4686.2
1748	4	1	1	4865.1
1749	12 m., station A	1	1	4924.0
1750	Station 10	1	1	5116.3
1751	3 p. m., station 17	1	1	5246.6
1752	Camp 88, dry camp	4	1	5284.4
1753	Station 5	1	1	5525.1
1754	12 m., station 7	1	1	5740.5
1755	Station 9	1	1	5654.5
1756	B	1	1	5968.9
1757	3 p. m., station 12	1	1	5928.0
1758	Station 18	1	1	6136.8
1759	Camp 89, Cosnino caves	28	2	6139.1
1760	Station 1	1	1	6214.8
1761	B	1	1	6353.2
1762	12 m., station C	1	1	6281.5
1763	Station D	1	1	6579.4
1764	Summit F	1	1	6749.7
1765	Camp 90, near San Francisco Springs.	4	1	6665.9
1766	Station 1	1	1	6696.8
1767	5	1	1	6796.2
1768	A	1	1	6971.4
1769	9	1	1	6945.4
1770	12 m., sta. 13, San F. spr'g	1	1	6952.1
1771	Station 18	1	1	7115.3
1772	19	1	1	7214.4
1773	22	1	1	7162.8
1774	3 p. m., station D	1	1	7272.9
1775	Camp 91, Leroux's spring	41	2	7378.4
1720	Camp 82, val'y of Flax riv.	51	2	*4752.3
1776	Station 1, $3\frac{1}{2}$ miles west of camp 82.	1	1	*4832.5
1777	Station 3, $12\frac{1}{2}$ miles west of camp 82.	1	1	*4890.6
1778	Sta. 4, bivouac, 22 miles west of camp 82, and 3 miles E. of Cañon Diablo.	1	1	*5116.7
1779	Junction of Cañon Diablo with Flax river.	1	1	*4594.3
1780	Bivouac 2, near mouth of Cañon Diablo.	------	1	†4594.3
1781	Station B	1	1	4956.0
1782	Bivouac 3, near Vol. hills	------	1	5394.3
1892	Foot of Volcanic peak	1	1	6167.3
1893	Top of same Volcanic peak	1	1	6661.0
1894	Pine camp, bivouac 4	------	1	6404.3
1895	Summit 1	1	1	6754.7
1896	Station B	1	1	6966.9
1897	Between stations 3 & 4 C	1	1	6942.4
1898	On side mountain, sta. 8	1	1	7723.1
1775	Leroux's spring, Camp 91	41	2	7378.4
1899	San Francisco spring	1	1	7002.0
1900	Bivouac at La Punta	------	1	7097.9
1759	Bivouac at Camp 89, Cosnino caves.	28	2	6139.1
1775	Camp 91, Leroux's spring.	41	2	7378.4
1901	Top of Triangulation hill.	2	1	‡8342.3
1902	Base of same	1	1	7543.4
1903	San Francisco peaks	------	------	§12,051.9
1775	Camp 91	41	2	‖7378.4
1783	Bivouac 1	3	1	7379.5
1784	Station 2	1	1	7397.1
1785	Bivouac 2, hill near New Year's spring.	5	1	6870.7
1786	Bivouac 3, base of Bill Williams' mountain.	3	1	6585.6
1787	Station 1	1	1	6846.3
1788	7	1	1	6575.7
1789	B	1	1	6496.5
1790	Bivouac 4, cañon of Bill Williams' creek	4	1	6347.1
1791	Bivouac 5, east branch of Partridge creek.	4	1	5154.7
1792	Station 2	1	1	5066.7
1793	Bivouac 6, head of north branch of Partridge cr'k.	3	1	5516.6
1794	Station 1, top of hill	1	1	5766.3
1795	Bivouac 7, near Lava cr'k.	2	1	6412.0
1775	Camp 91	41	2	¶7378.4
1796	Station A	1	1	7417.2
1797	6	1	1	7527.5
1798	12 m., station 7	1	1	7582.8
1799	Station 17	1	1	7351.0
1800	Camp 92, San Fran. forest.	9	2	7415.0
1801	Station 1	1	1	7430.2
1802	A	1	1	7480.6

* Reconnoissance west from camp 82, on Flax river, to Cañon Diablo, and thence northerly to its mouth.

† Reconnoissance from mouth of Cañon Diablo westward to Leroux's spring, and back to Cosnino caves.

‡ Three miles S. S. W. of Leroux's spring.

§ By triangulation the height is 4673.5 feet above camp at Leroux's spring. The limit of the growth of pines is 504.5 feet less, or 11,547.4 feet above the sea.

‖ Reconnoissance westward from Leroux's spring.

¶ Survey resumed from Leroux's spring.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1803	Station B.	1	1	7448.5
1804	5	1	1	7458.2
1805	12 m., C.	1	1	7284.2
1806	9	1	1	7312.6
1807	Camp 93, San Fran. prairie	8	2	7196.8
1808	Station A	1	1	7277.2
1809	B.	1	1	7166.2
1810	12 m., 12	1	1	7013.4
1811	C.	1	1	6906.8
1812	D.	1	1	6934.4
1813	E.	1	1	6792.6
1814	Camp 94, New Year's sp.	78	2	6738.7
1815	Station 1	1	1	6816.5
1816	A	1	1	6799.7
1817	B	1	1	6837.9
1818	12 m., C.	1	1	6691.3
1819	6	1	1	6750.4
1820	D	1	1	6492.7
1821	10 + 25 feet	1	1	6357.1
1822	F.	1	1	6451.4
1823	Camp 95, Lava creek	4	1	6317.7
1824	Station 1	1	1	6246.7
1825	4	1	1	6230.7
1826	5	1	1	6313.7
1827	12 m., 6	1	1	6205.3
1828	B.	1	1	6327.9
1829	E.	1	1	5906.0
1830	3 p. m., 13	1	1	5785.5
1831	Camp 96, Cedar creek	4	1	5671.7
1832	Station 2	1	1	5596.2
1833	4	1	1	5673.6
1834	A.	1	1	5826.9
1835	11	1	1	5565.5
1836	12 m., 14	1	1	5455.9
1837	17	1	1	5273.7
1838	B.	1	1	5406.1
1839	C	1	1	5381.2
1840	Camp 97, Partridge creek	16	2	5121.9
	Exploration from Camp 97 to Picacho, and thence northwest up China valley to Bivouac 4, and returning to Camp 99, at Picacho.			
1841	Bivouac 1, Partridge ck.	4	1	4965.5
1842	Bivouac 2, near Picacho sp.	4	1	4870.0
1843	Station 6	1	1	4731.9
1844	Bivouac 3, Val. de China.	2	1	4881.4
1845	Bivouac 4, N. W. branch of Val. de China.	4	1	5424.7
1846	Bivouac 5, near Picacho*	25	2	4835.8
	Reconnoissance from Bivouac 5, (Camp 99,) towards Mount Hope, and through Aztec Pass and back to Camp 103.			
1847	Bivouac 1, S. W. side of Val. de China.	2	1	5182.7
1848	Bivouac 2, near Mt. Hope.	2	1	5410.9
1849	Bivouac 3, ¼ mile east of Aztec Pass.	3	1	5938.4
1850	4 miles N. W. of Summit.	1	1	5800.2
1851	Summit of dividing ridge at Aztec Pass.	1	1	6240.8
1852	Bivouac 4, 2 miles E. of summit of Aztec Pass.	2	1	5739.3
1853	Bivouac 5, near Camp 103	10	2	5203.5
	Continuation of results upon the route.			
1853	Camp 103, on Pueblo ck.	10	2	5203.5
1854	Station 1	1	1	5244.6
1855	3	1	1	5316.5
1856	B.	1	1	5349.9
1857	St. 5 + 25 ft. C.	1	1	5389.9
1858	12	1	1	5550.9
1859	D	1	1	5546.9
1860	E.	1	1	5723.3
1861	F.	1	1	5629.1
1862	14	1	1	5710.9
1863	Ht. pt. 15	1	1	5835.6
1864	H	1	1	5711.7
1865	K	1	1	5746.2
1866	Sunset, 17	1	1	5735.6
1867	Camp 104, on Pueblo ck.	3	1	5688.9
1868	Station A	1	1	5739.4
1869	B	1	1	5690.9
1870	2	1	1	5759.0
1871	5	1	1	6025.1
1872	True summit of Aztec Pass	1	1	6058.0
1873	High pt., st. 6, on trail	1	1	6302.1
1874	7	1	1	6142.5
1875	8	1	1	5997.2
1876	9	1	1	5998.2
1877	Camp 105, on head-waters of Williams' river.	10	2	5751.7
1878	10.10 a. m., sta. A	1	1	5752.9
1879	Station B	1	1	5674.1
1880	12 m., station D	1	1	5518.4
1881	Station 4	1	1	5456.2
1882	Camp 106, br. Williams' r.	34	2	5360.3
	Exploration from Camp 106.			
1882	Camp 106	34	2	5360.3
1883	Bivouac 1, on branch of Williams' river.	3	1	4977.8
1884	Station 9, in cañon	1	1	4510.2
1885	10, top of cañon	1	1	4858.4
1886	Bivouac 2, S.E. part of Aquarius mountain.	4	1	4797.2
1887	Station 2, 50 feet below top of hill.	1	1	5629.5
1888	Bivouac 3, White Cliff crk.	3	1	4480.0
1889	Station 5, near camp 111, on White Cliff creek.	1	1	3610.5
1890	Bivouac 4, near springs, W. of Cactus Pass.	3	1	4126.0
1891	Bivouac 5, Cactus Pass, near camp 110.	10	1	5191.1
	Recommencement of regular survey of line from Partridge creek.			
1840	Camp 97, Partridge creek.	16	2	5121.9
1904	Station A	1	1	5232.7
1905	B	1	1	5186.8
1906	Camp 98, Partridge creek.			4990.0
1907	Station 5	1	1	4905.5

* Bivouac 5 is at the same point as Camp 99.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
1908	Station 8	1	1	4911.0	1964	Camp 117, on Williams' riv.	10	2	1499.4
1909	A	1	1	4902.2	1965	Station A, 12 m	1	1	1408.1
1910	11	1	1	5037.9	1966	Camp 118, on Williams' riv.	9	2	1307.7
1911	15, 3 p. m	1	1	4850.7	1967	Station A, 12 m	1	1	1257.1
1912	16	1	1	4936.0	1968	Camp 119, on Williams' riv.	10	2	1228.6
1913	Camp 99, Picacho springs	25	2	4835.8	1969	Station A, 12 m	1	1	1231.5
1914	Camp 100, Val de China, near Picacho.	12	1	4734.4	1970	Camp 120, on Williams' riv.	8	2	1184.5
					1971	Station A, 12 m	1	1	1072.1
1915	Camp 101, S.W. side of Val de China.	5	1	5104.4	1972	Camp 121, on Williams' riv.	20	3	1014.7
					1973	Station A, 12 m	1	1	957.6
1916	Station 5, 12 m	1	1	5412.8	1974	7, 3 p. m	1	1	870.5
1917	10, 3 p. m	1	1	5228.4	1975	Camp 122, on Williams' riv.	4	1	899.3
1918	Camp 102, Turkey creek	4	1	5513.1	1976	Station 2, 12 m	1	1	983.4
1919	Station 5, 12 m	1	1	5617.9	1977	Camp 123, on Williams' riv.	6	2	868.5
1853	Camp 103, Pueblo creek*	10	2	5203.5	1978	Station B, 12.30 p. m	1	1	781.9
1882	Camp 106, br. Wms'. river	34	2	5360.3	1979	Camp 124, on Williams' riv.	3	1	693.4
1920	Station 3	1	1	5243.6	1980	Station A, 9 a. m.	1	1	656.4
1921	7, 12 m	1	1	5279.1	1981	Camp 125, on Williams' riv.	5	1	504.4
1922	A	1	1	5066.8	1982	Station 1, 9 a. m	1	1	492.6
1923	10	1	1	5248.2	1983	A, 12 m	1	1	466.8
1924	12	1	1	5211.3	1984	Camp 126, on Williams' riv	2	1	441.1
1925	15, 3 p. m	1	1	4950.7	1985	Station A, 9 a. m	1	1	393.2
1926	Camp 107, br. Wms'. river	1	1	4811.8	1986	6, 12 m	1	1	378.3
1927	A	1	1	4954.1	1987	Station A, (2) 3 p. m., mo. of Williams' river.	1	1	356.4
1928	Station 3	1	1	4856.0					
1929	Camp 108, br. of Williams' river.	22	2	4814.0	1988	Camp 127, on Rio Colorado	7	2	398.4
			1		1989	Station 2	1	1	488.7
1930	Station A	1	1	4902.2	1990	A	1	1	416.0
1931	B	1	1	4910.6	1991	9, + 30 yds., 12 m	1	1	412.2
1932	3	1	1	5013.4	1992	Camp 138, on Rio Colorado	5	1	382.4
1933	C	1	1	4974.7	1993	Station D	1	1	582.8
1934	4	1	1	5004.1	1994	F	1	1	448.2
1935	D	1	1	4915.9	1995	5, 12 m	1	1	490.6
1936	Summit, station 7	1	1	4986.2	1996	Camp 129, on Rio Colorado	6	2	416.0
1937	Station E	1	1	4743.7	1997	Station A	1	1	488.5
1938	F	1	1	4789.3	1998	Water level, station B	1	1	453.0
1939	Camp 109, br. of White Cliff creek.	4	1	4784.5	1999	Station 7, 12 m	1	1	488.5
					2000	K	1	1	636.0
1940	Top of hill, station A	1	1	5071.6	2001	12	1	1	760.5
1941	12 m., station 10..	1	1	4941.9	2002	Camp 130, on bank near Rio Colorado.	4	1	589.8
1942	Camp 110, Cactus Pass	5	1	5166.1					
1943	Station 1	1	1	5268.1	2003	Summit, station 3, 12 m	1	1	1654.9
1944	3	1	1	4437.8	2004	Between 4–5, station B	1	1	1310.0
1945	6	1	1	3877.0	2005	Station 5, 3 p. m	1	1	1029.1
1946	Camp 111, White Cliff cr..	25	2	3526.1	2006	8, sunset	1	1	512.2
1947	Station 1	1	1	3434.8	2007	Camp 131, valley of Rio Colorado.	2	1	408.3
1948	Top of ridge, station 3	1	1	3489.5					
1949	Big Horn spring	1	1	2860.2	2008	Camp 132, valley of Rio Colorado.	6	1	431.8
1950	Camp 112, near Big Horn spring.	4	1	2783.9					
					2009	Station A	1	1	409.5
1951	Station A	1	1	2699.9	2010	5	1	1	393.5
1952	Junction of Williams' river with Big Sandy	1	1	2358.9	2011	Camp 133, valley of Rio Colorado.	2	1	432.9
1953	Station 11	1	1	2178.9	2012	Camp 134, valley of Rio Colorado.	5	1	432.9
1954	Camp 113, on Williams' riv.	4	1	2243.5					
1955	Station A, 12 m	1	1	2111.9	2013	Camp 135, valley of Rio Colorado.	5	1	430.3
1956	B, 3 p. m	1	1	2056.3					
1957	Camp 114, on Williams' riv.	3	1	1944.8	2014	Station B, 9 a. m	1	1	648.4
1958	Station A	1	1	1896.1	2015	C	1	1	967.5
1959	Camp 115, on Williams' riv.	9	2	1853.4	2016	4, 12 m	1	1	1220.6
1960	Station 1, 9 a. m	1	1	1810.5	2017	D, 3 p. m	1	1	1618.7
1961	8, 12 m	1	1	1744.6	2018	Camp 136, Prairie camp	3	1	2173.7
1962	Camp 116, on Williams' riv.	8	2	1656.8	2019	Station 2, 9 a. m.	1	1	2352.7
1963	Station A, 9 a. m.	1	1	1582.1	2020	Camp 137, Pai-ute creek..	5	1	2790.7

* For survey through Aztec Pass, from Camp 103 to Camp 106, see previous notes from No. 1853 to No. 1882.

APPENDIX M—Continued.

No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.	No. of barometer station.	Name of place.	No. of observations at station.	No. of barometers used.	Height, in feet, above mean tide.
2021	Station 2, 9 a. m	1	1	3618.0	2058	Camp 146, Mojave river	2	1	2178.0
2022	B, 9.40 a. m	1	1	3473.3	2059	Station 5	1	1	2229.4
2023	D	1	1	3560.6	2060	8, 12 m	1	1	2397.8
2024	F, 12 m	1	1	3694.0	2061	8, 3 p. m	1	1	2344.2
2025	P, 3 p. m	1	1	4206.4	2062	Camp 147, Mojave river	3	1	2473.7
2026	Camp 138, Yucca grove	3	1	4381.8	2063	Station 4	1	1	2611.0
2027	Station D	1	1	4741.3	2064	5, leave the riv.	1	1	2638.3
2028	E, summit	1	1	4887.8	2065	5 do.			
2029	A, foot of hill	1	1	4819.3	2066	Camp 148, E. slope of San Bernardino mts.	2	1	3442.6
2030	Camp 139, Rock spring	4	1	4896.8					
2031	Station 3	1	1	5003.7	2067	Station 2	1	1	3796.1
2032	5	1	1	5196.4	2068	4, summit of Cajon Pass.	1	1	4559.6
2033	6	1	1	5156.1					
2034	8	1	1	4602.8	2069	D	1	1	3844.1
2035	A	1	1	3618.5	2070	5	1	1	3505.6
2036	D	1	1	3770.2	2071	6, 12 m	1	1	2969.1
2037	Camp 140, near Marl spr's	2	1	3792.7	2072	Camp 149, Cajon creek	8	1	2527.5
2038	Station 1, Marl springs	1	1	3831.8	2073	Station 1, 9 a. m	1	1	2070.5
2039	D, 9 a. m	1	1	3472.9	2074	A	1	1	2081.5
2040	P	1	1	3775.9	2075	2	1	1	2039.5
2041	9, 12 m	1	1	3673.1	2076	D	1	1	1566.5
2042	H	1	1	3614.3	2077	F	1	1	1398.5
2043	B	1	1	2993.5	2078	Camp 150, Coco Mongo creek.	8	1	1223.5
2044	Camp 141, Sand Camp	3	1	2038.5					
2045	D, 9 a. m	1	1	1233.6	2079	Station D, 9 a. m	1	1	1039.9
2046	A, 12 m	1	1	928.7	2080	4	1	1	1055.3
2047	Camp 142, Soda lake	3	1	1001.7	2081	K	1	1	1085.7
2048	Station D, 9 a m	1	1	1033.4	2082	9, 12	1	1	857.1
2049	Camp 143, Mojave river	5	1	1216.1	2083	P, 3 p. m	1	1	598.5
2050	Station D, 9 a. m	1	1	1394.3	2084	H, sunset	2	1	364.9
2051	6, 12 m	1	1	1611.5	2085	Camp 151, San Gabriel creek.	1	1	249.1
2052	D, 3 p. m	1	1	1621.7					
2053	Camp 144, Mojave river	2	1	1659.1	2086	Station D, 9 a. m	1	1	300.7
2054	Station 4	1	1	1773.9		H	1	1	334.3
2055	Camp 145, Mojave river	10	1	1884.7	2087	Camp 152, 1½ mile east of Los Angeles.	20	2	352.0
2056	Station 1	1	1	1929.8					
2057	4, 12 m	1	1	2121.9	2088	S. Pedro, shore Pacific ocean	1	1	30.0

APPENDIX N.

TABLE OF DISTANCES AND GRADES.

Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.	Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.
1, Ft. Smith						49	0.5	21.5		10	
2	0.75	40		30		50	1.6	18.3	35		
3	0.4	Level.				51	1.8	Level.			
4	1.5	15	22			52	1.0	25.6	25		90
5	1.25	8.8		11	5	53	2.0	7.4	15		
6	3.40	2.6	14			54	1.3	16.1		20	
7	3.25	Level.				55	0.5	21.1	10		
8	2.4	4.1		10		56	0.9	11.7		10	
9	1.2	Level.			10.3	57	1.1	Level.			95.7
10	12.9	2.7	35			58	1.2	17.4		20	
11	2.8	10.4	30			59	2.5	12		30	
12	2.1	Level.			33.2	*b* 60	0.7	Level.			100
13	3.5	2.9	10			61	2.5	5.1	13		
14	5	11.9	60			62	4.2	6.4	27		106.7
15	0.7	6.9	5			63	4.4	13.5	60		
16	0.8	19.9	17			64	5.6	8.9	50		
17	0.4	4.7		2		65	3.5	11.2	40		120.3
a 18	1.2	12.9	15		45	*c* 66	2.0	20	40		
19	1.2	20.6		25		67	2.3	3		7	
20	4.6	Level.			50.7	68	0.9	30		28	125.6
21	0.8	23.7		20		69	1.4	17.5		25	
22	0.7	13.9		10		70	1.6	Level.			
23	1.3	7.9		10		71	0.9	11.7	10		
24	1.2	4.4		5	54.7	72	0.9	5.3	5		
25	1.2	4.1	5			73	1.2	4.3		5	
26	2.0	15.1	30			74	0.6	Level.			
27	1.3	7.8	10			75	1.1	18.5		20	
28	0.8	20.3	15		60	76	0.3	Level.			
29	1.4	10.1		15		77	0.8	13	10		
30	0.6	31		20		78	1.6	9.1	15		135.9
31	0.9	11.1	10			79	1.7	12.1		10	
32	1.2	20	25			80	1.1	Level.			
33	1.8	8.4		15	65.9	81	0.6	18		10	
34	2.2	2.3	5			82	0.5	20	10		
35	2.2	0.9	2		70.3	83	0.9	16.5			
36	0.7	44.6	33			84	0.4	Level.			
37	1.1	9.3	10			85	1.2	17.4	20		
38	0.9	22.4		20		86	0.8	36	30		
39	0.5	Level.				87	0.9	5.1		5	
40	2.4	16.8	40			88	1.1	40.5		45	145.1
41	1.5	20.6		30		89	0.6	Level.			
42	2.5	8.2	20		79.8	90	1.8	22.4	40		
43	1.2	Level.				91	0.5	Level.			
44	0.5	53		25		92	1.3	45	60		
45	0.6	43.3	25			93	0.8	24	20		150.1
46	0.8	6	5			94	0.6	17.5		10	
47	0.9	17·4		15		95	1.7	Level.			
48	1.2	7.7	10		85	96	0.6	16	10		

a Divide between Poteau and Sans Bois rivers. *b* Coal creek. *c* Divide between Coal creek and Boggy river.

APPENDIX N—Continued.

Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.	Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.
97	0.8	38.4	30			160	1.1	12		10	
98	1.0	10		10		161	2.5	2.1		5	
99	0.9	23		20		162	0.6	16		10	
100	0.7	14.3	10			163	1.1	37.6		40	225.1
101	0.7	42.9		30		164	1.2	8.5	10		
102	1.0	15	15			165	1.4	14.6	20		
103	0.5	30		15		166	0.9	34.5		30	
104	0.4	Level.				167	0.4	Level.			
105	0.8	37.5	30			168	2.2	18.8	40		
106	1.0	60	60		161	169	1.6	Level.			
107	0.5	Level.				170	0.8	25		20	
108	1.2	26.4	30			171	1.4	1.7		2	
109	1.2	65	80			172	2.5	Level.			
a 110	1.7	60	100		165.3	173	4.5	5	22		
111	1.8	56		100		174	5.5	3.6	20		
112	2.1	49		100		175	4.8	4.2	20		
113	3.1	19.5		60		176	2.9	6.8	20		
114	0.7	21.7	15			177	8.5	4.7	40		
b 115	1.4	14.4		25		178	5.1	8	40		
116	1.2	12.7	15			179	2.1	2.4		5	271.2
117	2.3	27	60			180	2.0	7.5	15		
118	0.6	16	10			181	7.7	5.2	40		280.9
119	1.2	16.5		20		182	5.7	3.5	20		
c 120	0.8	19.8		15	180.4	183	2.8	7.4	20		
121	1.8	8.6	15			184	3.2	6.4	19		
122	3.2	22	70		185.4	185	1.1	Level.			
123	0.8	23.5		20		186	3.3	6	25		
124	0.4	28	10			187	0.9	Level.			
125	2.0	30		60		188	0.6	16	10		
126	0.8	13.4		10		189	4.2	4.8	20		
d 127	0.7	22.5		15	190.1	190	1.6	10.4	15		
128	2.0	17.9	35			191	0.6	Level.			
129	1.1	27	30			192	1.3	11.8	15		
130	0.4	11.8		5		193	1.3	Level.			
131	2.4	21	50			194	2.9	6.5	19		
132	1.2	40	45			195	1.1	Level.			
133	1.2	16.6	20			196	1.6	9.8	16		
134	1.0	39.6	40			197	1.2	Level.			314.6
135	0.5	Level.				198	1.0	4.8	5		315.6
136	0.5	23	10		200.3	199	1.6	6.4	10		
137	0.6	Level.				200	1.0	Level.			
138	1.0	39.3		40		201	1.4	19.2	26		
139	1.0	45.4		45		202	0.5	11.5		6	320.1
140	1.5	27	40			203	1.3	3.7	5		
141	0.7	22.5		15		204	0.4	36	15		
142	1.5	41.4	60			205	0.8	12.8		10	
143	0.6	Level.				206	1.0	20.3	20		
144	0.8	18	15			207	1.9	5.3	10		325.5
145	0.9	36.2		35		208	1.0	Level.			
146	0.3	Level.				209	1.4	7.5	10		
147	0.5	40	20			210	2.1	Level.			330
148	0.9	Level.				211	1.2	8.5	10		
149	0.8	12	10			212	0.6	8.5		5	
150	0.8	Level.				213	0.6	26	14		
151	1.3	19.3		25		214	1.7	9		14	
152	0.9	5.4	5			215	1.6	7.2	11		335.7
153	0.8	Level			215.4	216	0.4	10.8	4		
154	0.7	36.9	25			217	1.0	10	10		
155	0.5	10.5		5		218	1.2	8.6		10	
156	1.0	Level.				219	0.6	Level.			
157	0.7	14.8	10			220	0.5	36	20		
158	1.0	9.9		10		221	0.9	11.9		10	340.4
159	0.6	30.4	20			222	2.6	Level.			

a Summit of Delaware ridge.
b Topofki creek.
c Mustang creek.
d Beaversville creek.

APPENDIX N—Continued.

Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.	Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.
223	1.7	12.4	20			*e* 281	0.9	Level.			
224	0.4	Level.			345.1	*e* 282	9.8	8	78		530
225	1.7	23.2	40			283	10	8	80		540
226	1.5	6.8	10			284	10	8	80		550
227	0.7	56	40			285	10	8	80		560
228	0.5	Level.				286	10	8	80		570
229	0.9	63	55		350.5	287	10	8	80		580
230	1.2	75.6	90			288	10	8	80		590
231	0.2	Level.				289	10	8	80		600
232	0.9	66	60			290	10	8	80		610
233	0.7	Level.				*f* 291	10	8	80		620
234	0.5	63	30			*g* 292	10	10	100		630
235	0.3	Level.				293	10	10	100		640
236	1.0	30.6	30		355.4	294	10	10	100		650
237	0.6	15.5	10			295	10	10	100		660
238	0.9	33.9	30			296	10	10.6	106		670
239	0.3	67	20			297	10	10.6	106		680
240	0.7	43	30			298	10	11.5	115		690
241	0.5	20	10			299	11.5	11.8	135		701.5
242	1.5	46	70			300	2.4	20.6	50		
a 243	1.4	28.6	40		361.7	*h* 301	1.5	32.5	50		705.5
244	4.6	60		280		302	2.2	70	150		
b 245	0.8	6.7		5	367.1	303	1.2	78.3	90		
b 246	2.9	5	14		370	304	0.5	Level.			
b 247	10	5	50		380	305	1.4	14.5		20	710.7
b 248	10	5.6	56		390	306	1.4	44.4	60		
b 249	10	5	50		400	307	0.8	25.2	20		
b 250	10	7.5	75		410	308	1.2	Level.			
b 251	10	7.5	75		420	309	1.8	54	100		
b 252	10	7.5	75		430	*i* 310	2.2	69	150		718
b 253	10	7.5	75		440	311	0.6	Level.			
b 254	10	7.5	75		450	312	1.1	18		20	
b 255	10	8	80		460	*j* 313	8.7	7.5		65	
b 256	10	8	80		470	314	1.6	53.9	85		730
b 257	10	8	80		480	315	2.7	49	130		
b 258	5.6	8	45		485.6	316	3.2	6.4		20	735.8
c 259	1.9	92	179			317	0.7	15.1		10	
c 260	3.9	70	200		590.4	318	1.6	Level.			
c 261	0.7	28	20			*k* 319	1.3	47.4		60	739.5
c 262	0.6	Level.				*l* 320	1.8	72.8	130		
c 263	0.8	42	35			321	0.6	18		10	
c 264	0.9	5.5		5		*m* 322	3.3	60		200	745.1
c 265	1.3	7.8		10		323	1.3	31.6	40		
c 266	2.2	Level.			496.9	324	3.2	80	250		
c 267	2.5	36	90			325	3.2	93.7	300		
c 268	1.4	Level.			500.8	326	0.8	64.5	50		
c 269	2.3	13		30		327	0.7	42		30	
c 270	2.8	Level.			506	328	1.6	19		30	755.8
c 271	1.1	37.6	40			329	0.2	Level.			
c 272	1.5	41.4	60			330	1.7	63	110		
c 273	0.5	60		30		331	0.6	Level.			
c 274	1.1	Level.			510	332	0.6	62	40		
c 275	0.7	28	20			333	1.4	14	20		760.5
c 276	1.2	8.7		10		334	1.7	30	50		
c 277	1.6	68		110		335	2.1	42.8	90		
d 278	1.4	36		50	515	336	1.9	51.5	100		
279	2.5	32		80		337	0.8	58.5	50		
e 280	1.8	22		50	519.3	*n* 338	1.4	11.1	15		768.5

a Summit of Divide between Washita and Canadian.
b Valley of Canadian river.
c Table land south of Agate bluffs.
d Valley of Shady creek.
e Valley of Canadian river.
f Near mouth of Tucumcari creek.
g Near junction of Pajarito creek.
h Head of Pajarito creek.
i Divide between Hurrah creek and Rio Gallinas.
j Crossing of Rio Gallinas.
k Sheep Spring creek.
l Divide between Sheep spring and Rio Pecos.
m Crossing of Rio Pecos.
n Divide between Rio Pecos and Cañon Blanco.

APPENDIX N—Continued.

Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.	Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.
a 339	1.1	58.5		65	769.5	395	10	26	258		930
340	2.5	20		50		396	7.3	26	190		
341	1.5	6.8	10			397	7.4	33.3	245		
342	3.2	16	50			398	5.2	9.5	50		950
343	3.2	35.8	120			399	10	9.5	95		960
344	3.8	60	220			*j* 400	6.3	9.5	60		966.3
345	1.4	72	100			401	3.7	50		185	970
b 346	1.0	80	80		786	402	2.3	50		115	
347	0.5	36		20		403	1.3	40		50	
c 348	1.8	55.6		100		404	0.7	30		20	
349	1.7	Level.			790	405	2.0	26		53	
350	0.5	41.7		20		*k* 406	3.7	18		67	980
351	1.0	31	30			407	3.4	18		60	
352	0.8	12.5		10		408	6.6	15		100	990
353	1.7	54.2		90		409	10	14.3		143	1000
354	0.9	77.8		70		410	10.6	14.8		157	1010.6
355	6.4	62.5		400	801.2	411	9.4	14.2		133	
356	1.5	40		60		412	4.4	15.2		67	
357	1.2	Level.				413	5.6	13.8		77	1030
358	0.6	15.4	10			414	10	13.1		131	1040
359	3.7	43.7	160			415	10	13.2		132	1050
360	1.5	32.5	50		810	416	10	13.8		138	1060
361	1.7	51.4	90			417	9.8	12.4		122	
362	0.5	96.2	50			418	7.5	13.3		100	
363	1.6	63.3	100			*l* 419	10.2	9.8		100	1087.5
d 364	0.5	55.5	30			420	2.5	9.2		23	1090
365	0.6	Level.			814.9	421	8.4	9.2		77	
366	1.1	72.7		80		422	11.6	9.1		106	1110
367	0.8	66		50		*m* 423	12.6	8.6		108	1122.6
368	2.3	Level.				424	2.4	47.5	114		1125
369	1.4	74	100		820.4	425	1.1	30	33		
e 370	1.3	61.6	80			426	0.5	10		5	
371	6.0	105.7		630		427	1.3	47		61	
372	2.4	82		200		428	1.0	4		4	
373	5.3	75		400		429	1.2	10	12		1130.1
374	0.8	63.5		50		430	2.0	50	100		
375	5.2	39		200		431	3.1	4.8	15		1135.3
376	3.1	32		100		432	3.3	26.2	84		
377	4.0	25		100		433	2.0	12.5	25		
f 378	1.5	28		40	850	434	3.0	35.3	106		
g 379	1.4	7.4		10		435	1.5	8	12		1145.2
380	2.0	44	90			436	1.5	3.3		5	
381	0.7	52.5		35		*n* 437	2.0	6		12	1148.7
382	1.6	60	95		855.7	438	2.0	14.5	29		
383	3.4	43.5	150			439	9.3	40	371		1160
384	3.8	76	285			440	10	40	400		1170
385	1.0	Level.				441	10	40	400		1180
386	1.7	21		35	865.5	442	1.6	62.5	100		
387	1.8	56		100		*o* 443	3.7	85.4	316		1185.2
388	3.3	46.5		150		444	0.9	73.3		66	
h 389	1.6	51.6		80	872.2	445	1.8	55.5		100	
i 390	7.8	17.3	130		880	446	1.3	Level.			
i 391	10	17.5	175		890	447	2.9	86.2	250		
i 392	10	17.5	175		900	448	2.2	91	200		
i 393	11.8	17.8	210		911.8	449	1.8	90	160		
i 394	8.2	26	192		920	450	1.0	44	44		

a Cañon Blanco.
b Divide between Cañon Blanco and Lagunas; altitude 6880.
c Las Lagunas.
d Divide.
e Summit of San Antonio Pass; altitude 6680.
f East bank of Rio Grande.
g Isleta.
h Crossing of Rio Puerco.
i Valley of Rio San José.
j Summit of Sierra Madre at Campbell's Pass; altitude 6950.
k Ojo del Oso.
l Junction of Rio Puerco with Flax river.
m Crossing of Flax river.
n Crossing of Cañon Diablo.
o Divide between Flax river and Rio Verde.

APPENDIX N—Continued.

Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.	Station.	Dist. in miles.	Grade, in feet, per mile.	Ascent, in feet.	Descent, in feet.	Dist. from Fort Smith, in miles.
a 451	2.3	65.2	150			492	9.7	42.4		409	1313.2
452	1.2	82	100		1200.7	493	0.4	12.9	5		
453	1.0	84.6	88			*g* 494	0.4	65		26	1314
b 454	0.3	Level.				495	1.6	26.9		44	1315.6
455	1.5	90.2		138	1203.5	496	3.9	29.5		115	
456	0.7	75.3		50		497	7.1	24.5		175	1326.6
457	2.0	51.3		100		498	7.0	87		609	
458	1.9	42.8		80		*h* 499	1.6	18.5	29		1335.1
459	1.3	16.2		20		500	2.7	69.6		190	
460	1.2	40.6		50	1210.7	*i* 501	3.6	Level.			1341.5
461	1.3	38.5		50		502	16.4	11.5	190		
462	0.7	43	30			*j* 503	37.4	92.4		3,450	1395.2
463	0.4	85.7		30		504	1.0	Level.			
464	2.3	6.6	15		1215.2	505	9.0	22	198		1405.2
465	1.0	14.7		15		506	5.5	58.2	320		
466	3.0	50.7		150		507	5.7	45	259		1416.4
467	1.5	Level.			1220.7	508	35.1	73.3	2,573		1451.5
468	5.4	36.8		200	1226.2	*k* 509	5.0	80	400		1456.5
469	5.5	36.8		200	1231.6	510	8.5	100		850	1465
470	4.0	88.8		355		511	5.0	95		475	1470
471	4.1	88.8		365		512	5.0	90		450	1475
472	4.7	72		340		513	5.0	85		425	1480
473	4.8	72		340		514	5.0	75		375	1485
474	4.8	71		340	1254	515	3.0	70		210	
c 475	4.4	6.2		27		*l* 516	4.0	66		264	1492
476	0.3	70	17			*m* 517	13.2	5	65		1505.2
477	4.0	25	100			518	4.8	38.3	184		1510
478	0.9	40	38			519	5.0	42.2	211		1515
479	0.9	11		10		520	12.2	13.3	163		1527.2
480	1.0	28		28	1265.4	521	3.8	29.4	111		1531
481	4.8	73	350		1270.2	522	20.9	14	293		1551.9
482	1.4	71	100			523	6.3	8	51		1558.2
d 483	5.4	37	200		1277	*n* 524	4.4	16.7	74		1562.5
484	0.9	56	50			*o* 525	5.0	27	135		1567.5
485	0.8	Level.				*p* 526	25	2		50	1592.5
486	5.7	44.2	250			527	9.5	Level.			1602
487	4.5	44.2	200			*q* 528	23.5	38.8	912		1625.5
e 488	1.9	28.8	55		1290.7	(*r*)	326.5		708	4,008	1952
489	1.0	55		57							
f 490	4.0	61.9		246	1295.7	*s* Total	1952.0		23,543	23,996	1952
491	7.8	65		508							

a Near Leroux's spring.
b Highest summit, 7,538 feet.
c Val de China.
d Near Pueblo creek.
e Summit of Aztec Pass, 6,055 feet.
f Headwaters of Williams' river.
g Cross mountain.
h Crossing of trail.
i Crossing of Big Sandy.
j Crossing of Rio Colorado.
k Summit of Pai-ute range.
l Soda lake.
m Mojave river.
n Point of leaving the river.
o Summit.
p Dry lake.
q Entrance to Tah-ec-chay-pah Pass.
r San Francisco, California.
s From Fort Smith to San Francisco.